United States Department of the Interior

FISH AND WILDLIFE SERVICE
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Memorandum

To: Regional Director, Bureau of Reclamation, Mid-Pacific Region
Sacramento, California

Michael B. Hoover

From: Acting Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Draft Fish and Wildlife Coordination Act Report for the Battle Creek Salmon and Steelhead Restoration Project

This memorandum transmits the U.S. Fish and Wildlife Service's (Service) Administrative Draft Fish and Wildlife Coordination Act (FWCA) Report, as provided for in Section 2(b) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended) for the Battle Creek Salmon and Steelhead Restoration Project (Restoration Project). The U.S. Bureau of Reclamation (Reclamation) is the lead Federal agency for Restoration Project implementation.

The Restoration Project was developed to restore anadromous fish habitat in about 42 miles of the mainstem and North and South Fork Battle Creek downstream of each fork's naturally impassable waterfalls, and an additional 6 miles of Battle Creek's tributaries, while minimizing the loss of hydropower production. The Restoration Project is expected to considerably benefit anadromous fish and other aquatic species in Battle Creek by increasing quantity and quality of instream habitat and improving fish passage; however, some project components would have incidental adverse impacts in the stream channel and some upland, riparian, and wetland habitats within the construction footprints would be lost.

This report reviews the proposed action and alternatives, and summarizes potential beneficial and adverse effects on fish and wildlife resources. Recommendations are provided to help maximize project benefits and avoid, minimize, and compensate for incidental adverse effects in accordance with the Service's Mitigation Policy (Federal Register 46(15):7644-7663). Appropriate mitigation of adverse effects would help ensure that the Restoration Project provides the greatest possible benefits to overall ecosystem quality in the project area.

In accordance with the FWCA, copies of this draft report have been provided to NOAA Fisheries and California Department of Fish and Game (CDFG) for their review and input. The draft report also will appear as an appendix to the Restoration Project's Environmental Impact Statement/Environmental Impact Report. As a draft document, the contents of the report are provisional and subject to revision. The Service invites comments regarding the data, assessments, views, and recommendations provided in the report. Consultation pursuant to the FWCA will continue throughout project planning, and a final FWCA report will be submitted to Reclamation for their consideration prior to completing the Restoration Project's Record of Decision.

The Service appreciates the opportunity to comment and contribute to the Battle Creek Salmon and Steelhead Restoration Project planning process. If you have any questions regarding the draft FWCA report, please contact Bart Prose of my staff at (916) 414-6600.

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Fish and Wildlife Coordination Act Report

Battle Creek Salmon and Steelhead Restoration Project

Sacramento Fish and Wildlife Office
U.S. Fish and Wildlife Service
Sacramento, CA

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INTRODUCTION

This Fish and Wildlife Coordination Act (FWCA) Report comprises the recommendations of the U.S. Fish and Wildlife Service's (Service) based on surveys and investigations, as provided for in Section 2(b) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended), for the Battle Creek Salmon and Steelhead Restoration Project (Restoration Project). The FWCA is intended to help develop and improve fish and wildlife resources in connection with Federal projects and projects carried out under Federal permits and licenses that affect bodies of water, and prevent the loss of, or damage to, fish and wildlife from such projects. The U.S. Bureau of Reclamation (Reclamation) is the lead Federal agency for Restoration Project implementation.

The report reviews the proposed action and alternatives, and summarizes potential beneficial and adverse effects on fish and wildlife resources. Recommendations are provided to help maximize project benefits, and avoid, minimize, and compensate for incidental adverse effects in accordance with the Service's Mitigation Policy (Federal Register 46(15):7644-7663). Although effects on hydroelectric facilities and economics are not addressed in this report, the Service supports the Restoration Project's Purpose and Need, which includes minimizing loss of hydroelectric power production. Carefully considered selection and implementation of an alternative, mitigation of adverse effects, and enhancement of other affected habitat in the Restoration Project area, where warranted, would help ensure that the Restoration Project most fully meets its purpose, and provides the greatest possible ecosystem benefits.

The Service's evaluations and recommendations are based on resource descriptions and project information available at the time of the report's preparation, including the Memorandum of Understanding for proposed restoration of Battle Creek (Restoration Project MOU)(MOU Parties 1999); draft descriptions of project alternatives (USBR and SWRCB 2003); field surveys and reports; draft engineering designs; Biological Assessment (BA) for operation of the Coleman National Fish Hatchery (CNFH) (USFWS 2001a); impact assessment data in the Restoration Project's Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) (USBR and SWRCB 2003); and meetings among the involved resource agencies, Pacific Gas and Electric Company (PG&E), and non-government organizations.

In accordance with the FWCA, copies of this draft report have been provided to National Oceanic and Atmospheric Administration (NOAA) Fisheries and California Department of Fish and Game (CDFG) for their review and input. The draft report also will appear as an appendix to the Restoration Project's EIS/EIR. As a draft document, the contents of the report are provisional and subject to revision. The Service invites comments regarding the data, assessments, views, and recommendations provided in the report. Consultation pursuant to the FWCA will continue throughout project planning, and a final FWCA report will be submitted to Reclamation for their consideration prior to completing the Restoration Project's Record of Decision (ROD).

BACKGROUND

Declining Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) populations in the Sacramento River system (the mainstem river and its tributaries) have been attributed to several factors, including, water supply development, inadequate stream flow, rapid flow fluctuations, high summer and fall water temperatures in streams below diversions, dams that block access to upstream habitat, entrainment of juvenile fish into unscreened or poorly screened diversions, sedimentation, and over-harvest (USFWS 1995). These population declines have resulted in the need to implement habitat restoration actions throughout the Sacramento River system as one way to preserve and enhance populations.

Battle Creek is recognized as the most important Sacramento River tributary for restoration of Chinook salmon and steelhead (Kier 1991). Before hydroelectric and other land development in the watershed, Battle Creek provided a contiguous stretch of prime habitat for anadromous Chinook salmon and steelhead trout from its confluence with the Sacramento River upstream to naturally impassable waterfalls. Hydroelectric power development and hatchery operations on Battle Creek have affected annual runs of naturally produced Chinook salmon and steelhead trout. Impaired fish passage and instream flows have been the primary factors. Restoration of anadromous fisheries in Battle Creek has been identified as a priority in several fishery restoration plans developed by State and Federal resource agencies (CRA 1989, CDFG 1990, CDFG 1993, CDFG 1996a, CDFG 1996b, CALFED 2000a, USFWS 2001b).

In early 1999, the Battle Creek Salmon and Steelhead Restoration Plan (Kier Associates 1999) was completed as a collaborative effort among Reclamation, NOAA Fisheries, the Service, California Department of Fish and Game (CDFG), Pacific Gas & Electric Company (PG&E), and other Battle Creek Working Group (BCWG) stakeholders. The Plan provides biological criteria and information supporting restoration and identifies physical actions and monitoring measures that would be necessary. The following principles were considered essential by Reclamation, NOAA Fisheries, the Service, and CDFG for salmonid restoration and a necessary component of the negotiated Restoration Project:

- Biological Effectiveness - Restoration actions must incorporate the most biologically effective remedies that provide the highest certainty to successfully restore ecosystem functions and self-sustaining populations of native fish in a timely manner.

- Restoring Natural Processes - Restoration actions must incorporate measures that mimic the hydrologic conditions under which Battle Creek anadromous fish resources evolved by increasing baseflows and eliminating mixing of North Fork and South Fork waters.

- Biological Certainty - Restoration actions must provide maximum long-term effectiveness by minimizing long-term dependence on the integrity of man-made restoration actions and the cooperation of future project owners and operators.

In June 1999, the Restoration Project MOU, which defined the mutual intent to restore salmon and steelhead in Battle Creek in relation to PG&E's Hydroelectric Project (Hydroelectric Project) facilities and included proposed restoration components and protocols for implementation, was signed by Reclamation, NOAA Fisheries, the Service, CDFG, and PG&E (MOU Parties). The MOU Parties expected to realize the following benefits (MOU Parties 1999):

- Restoration of self-sustaining populations of Chinook salmon and steelhead and their habitat in the Battle Creek watershed through a voluntary partnership with State and Federal agencies, a third party donor(s), and PG&E.

- Up-front certainty regarding specific restoration components, including Resource Agency prescribed instream flow releases, selected decommissioning of dams at key locations in the watershed, dedication of water diversion rights for instream purposes at decommissioned sites, construction of tailrace connectors, and installation of fail-safe fish screens and fish ladders.

- Timely implementation and completion of restoration activities.

- Joint development and implementation of a long-term Adaptive Management Plan with dedicated funding sources to ensure the continued success of restoration efforts under this partnership.

In support of the completed Restoration Project MOU, the CALFED Bay-Delta Program (CALFED) provided funding for planning and implementation of resource agency portions of any approved actions of the Restoration Project. The Restoration Project is supported by several directives of CALFED, as recounted in CALFED's Ecological Restoration Program (ERP) (CALFED 2000a) and Multi-Species Conservation Strategy (MSCS) (CALFED 2000c). The goal of the Ecosystem Restoration Program is to:

> "... improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta system [including the Sacramento River Basin] to support sustainable populations of diverse and valuable plant and animal species through an adaptive management process." (CALFED 2000b).

The ERP (along with CALFED's water management strategy) is designed to achieve or contribute to the recovery of Bay-Delta species listed under the State and Federal Endangered Species Acts and, thus, achieve the goals of the MSCS (CALFED 2000b). The ERP establishes adaptive management as the primary tool for achieving ERP objectives and making future decisions for large-scale ecosystem restoration (CALFED 2000a). Stage 1 actions and milestones for implementing the ERP and MSCS have been identified for Battle Creek in the Programmatic Biological Opinions for CALFED provided by NOAA Fisheries (NMFS 2000) and the Service (USFWS 2000). Stage 1 actions are:

- Improve fish migration by removing diversion dams, upgrading fish passage facilities, and screening diversions.

- Improve instream flows in lower Battle Creek to provide adequate passage flows.

- Develop and implement a watershed management plan to reduce the amount of fine sediments introduced into the creek channel, to protect and restore riparian habitat, to improve base flows, and to reduce water temperatures.

Stage 1 milestones are:

- Design and begin implementation of an ecologically based stream flow regulation plan for Battle Creek.

- Develop and implement a solution to improve passage of upstream migrant adult fish and downstream migrant juvenile fish in Battle Creek.

The Restoration Project also is consistent with the ERP's Watershed Program, which supports local and regional activities that improve the ability of watersheds to function as a contributor to the health of the entire Bay-Delta system (CALFED 2000d). The Watershed Program supports improvement of ecosystem quality through restoration projects, stating that:

> "Watershed activities that improve riparian habitat, increase or improve fisheries habitat and passage, restore wetlands, or restore the natural stream morphology affecting downstream flows or species may benefit ecosystem quality"

Desired outcomes from the Watershed Program include improved watershed ecosystem maintenance and enhancement. CALFED may support projects or programs that address:

> "Streamflow Enhancements - Planning, management and project activities that maintain or restore appropriate stream flows in the tributary streams to the Bay-Delta system." "Particular emphasis will be on the restoration or maintenance of appropriate seasonal patterns that will sustain important ecological systems and successions." Examples include sediment balance, geomorphic stabilization, water quality enhancement, and improved spawning habitat (CALFED 2000d).
>
> "Biological Diversity Maintenance and Improvement - Programs, projects and other actions that maintain and conserve existing diversity will be supported. In addition, support will be provided for actions and programs that are intended to improve the diversity of appropriate local biological communities including riparian corridors, aquatic communities, wetlands, floodplains, forests and uplands" (CALFED 2000d).

The Restoration Project also is conceptually consistent with ecosystem-level restoration approaches specified by the Central Valley Project Improvement Act (CVPIA), which states:

> “The mitigation of fish and wildlife losses incurred as a result of construction, operation, or maintenance of the Central Valley Project shall be based on the replacement of ecologically equivalent habitat ...” and “... give first priority to measures which protect and restore natural channel and riparian habitat values ...”

Further, the restoration plan for the CVPIA’s Anadromous Fish Restoration Program (AFRP) (USFWS 2001b) states that:

> “Protecting and restoring natural channel and riparian habitat values promotes natural processes that regulate geomorphic characteristics, nutrient dynamics, and production capabilities of streams, rivers and estuaries.”

The restoration components and protocols proposed in the Restoration Project MOU, comprise the Proposed Action of the Restoration Project. The Proposed Action and several alternatives are the focus of the Battle Creek Salmon and Steelhead Restoration Project. The Restoration Project was designed to restore and enhance approximately 42 miles of habitat in North and South Fork Battle Creek downstream of naturally impassable waterfalls, including about 6 miles of its tributaries, while minimizing the loss of hydropower production (USBR and SWRCB 2003). Restoration Project objectives are:

1. Restore self-sustaining populations of Chinook salmon and steelhead by restoring their habitat in the Battle Creek watershed and access to it through a voluntary partnership with State and Federal agencies, a third party donor(s), and PG&E.

2. Establish instream flow releases that restore self-sustaining populations of Chinook salmon and steelhead.

3. Remove selected dams at key locations in the watershed where the hydroelectric values were marginal due to increased instream flow.

4. Dedicate water diversion rights for instream purposes at dam removal sites.

5. Construct tailrace connectors and install fail-safe fish screens and fish ladders to provide increased certainty about restoration components.

6. Restore stream function by structural improvements in the trans-basin diversion to provide a stable habitat and guard against false attraction of anadromous fish away from their migratory destinations.

7. Avoid Restoration Project impacts on species of wildlife and native plants and their habitats to the extent practicable, minimize impacts that are unavoidable, and restore or compensate for impacts.

8. Minimize loss of clean and renewable energy produced by the Battle Creek Hydroelectric Project.

9. Implement restoration activities in a timely manner.

10. Develop and implement a long-term adaptive management plan with dedicated funding sources to ensure the continued success of restoration efforts.

11. Avoid impacts on other established water users/third parties.

Habitat restoration and enhancement is particularly important for spring-run Chinook salmon, which are listed as threatened under the Federal and State Endangered Species Acts, winter-run Chinook salmon, which are State and Federally listed as endangered, and steelhead trout, which are federally listed as threatened within the Sacramento River and its tributaries. During some periods of the year, the needs of different species, runs, and lifestages can conflict in a given reach of the creek. Some balancing of differing needs can be achieved through short-term flow adjustment, but priority would ultimately be given to winter-run Chinook salmon, spring-run Chinook salmon, steelhead, late fall-run Chinook salmon, and fall-run Chinook salmon, in that order (USBR and SWRCB 2003).

Pursuant to the Restoration Project MOU, the Proposed Action calls for contributions from PG&E in the form of forgone energy generation, pursuit of an amendment to the Hydroelectric Project's Federal Energy Regulatory Commission (FERC) license, transfers of certain water rights to CDFG, and a variety of other requirements (USBR and SWRCB 2003). The MOU also provided for the partial funding of adaptive management through a separate third-party funding agreement. The total cost of restoration actions defined in the Restoration Project MOU was estimated at $50.7 million[1]; $27.2 million to be provided by Federal sources, $20.6 million by PG&E, and $3 million by third party donors (MOU Parties 1999).

FISH AND WILDLIFE SERVICE MITIGATION POLICY

The Service's views and recommendations contained in this report are guided, in part, by the Service's Mitigation Policy, which provides guidance to protect or conserve fish and wildlife resources. The intent is to protect and conserve the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources. The Mitigation Policy defines mitigation to include avoiding impacts, minimizing impacts, rectifying impacts, reducing or elimination impacts over time, and compensating for impacts. The Service considers the stated order of mitigation elements to represent the most desirable sequence of steps in the mitigation planning process.

[1]Reclamation presently estimates that an additional $34 million would be needed to complete construction of the Restoration Project.

Under the policy, fish and wildlife resources are divided into four Resource Categories to ensure that recommended mitigation is consistent with the fish and wildlife habitat values affected (Table 1). The four categories cover a range of habitat values from unique and irreplaceable to more common and of relatively less value to fish and wildlife. Corresponding mitigation goals are determined, accordingly, based on the habitat's scarcity or uniqueness and its perceived value to fish and wildlife species (the Mitigation Policy does not apply to species listed, or proposed for listing, under the ESA).

In addition to considerations and goals of its Mitigation Policy, the Service is further attentive to protection of wetland habitats. The Service has long recognized the importance of wetlands to waterfowl, other migratory birds, fish, and wildlife. Wetlands provide important fish and wildlife benefits as well as other significant functions (flood control, water quality maintenance, water supply, recreation, and scientific research) to the nation. Destruction of wetlands eliminates or reduces these values. It is the public's best interest to protect wetlands and maintain these values for this and future generations. The Service's Region 1 policy is to

Table 1. Service Mitigation Policy for Resource Categories and mitigation planning goals.

Resource Category	Designation Criteria	Mitigation Planning Goal
1	High value for evaluation species and unique and irreplaceable	No loss of existing habitat value
2	High value for evaluation species and scarce or becoming scarce	No net loss of in-kind habitat value[1]
3	High to medium value for evaluation species and abundant	No net loss of habitat value while minimizing loss of in-kind habitat value
4	Medium to low value for evaluation species	Minimize loss of habitat value

[1]Unavoidable losses of habitat value would need to be replaced in-kind. In-kind replacement means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate to those lost.

view wetland degradation or losses as unacceptable changes to an important national resource. It is the goal of the Service's Region 1 to ensure that no net loss (acreage or value, whichever is greater) of wetland habitats occurs. For the purposes of this policy, wetlands are defined according to Cowardin et al. (1979).

PROJECT AREA

Battle Creek is a tributary of the upper Sacramento River in Shasta and Tehama counties, California. Battle Creek and its tributaries flow westward from the Sierra Nevada foothills, intersecting the Sacramento River between Red Bluff and Redding, and encompasses a watershed of 357 square miles (USBR and SWRCB 2003). Battle Creek flows through deep, shaded canyons and riparian corridors. The mountain stream is maintained by cold, spring-fed water. The overall gradient of Battle Creek is high, falling over 5,000 feet in less than 50 miles. Battle Creek has two main forks, North Fork Battle Creek and South Fork Battle Creek. The split of the two forks occurs about 12 miles east of Battle Creek's confluence with the Sacramento River. The Restoration Project area comprises about 42 miles of the mainstem and North and South Fork Battle Creek, downstream of each fork's natural fish barrier waterfalls to the confluence with the Coleman Powerhouse tailrace channel on the mainstem, and an additional 6 miles of Battle Creek tributaries.

The Hydroelectric Project facilities in the Restoration Project area are owned and operated by PG&E under FERC license number 1121 (USBR and SWRCB 2003). The system includes a series of water diversions, several long canals, and low-volume/high-head power generators, including five powerhouses (Volta 1, Volta 2, South, Inskip and Coleman) with a combined nameplate capacity of 36.3 MW. FERC license instream flow requirements for the watershed are 3 cubic feet per second (cfs) instream flow below all North Fork Battle Creek diversions and 5 cfs instream flow below all South Fork Battle Creek diversions.

In 1995, PG&E began providing increased instream flows (up to 30 cfs) below Eagle Canyon and Coleman Diversion Dams to improve instream habitat below these dams in anticipation of the Restoration Project. The increased flows were provided under two successive interim agreements between PG&E and Reclamation; with concurrence of CDFG, NOAA Fisheries, and the Service; which provided partialfinancial compensation to PG&E for forgone power generation. The agreements also included temporary closure of fish ladders at Eagle Canyon and Coleman diversion dams, and suspended diversions at Wildcat Diversion Dam. The ladder closures and suspended diversions are intended to confine anadromous fish to areas benefitting from interim flow enhancement, and protect juvenile anadromous fish from entrainment into unscreened diversions. Although the second agreement expired on February 28, 2001, PG&E has continued conditions of the agreement until a continuing interim agreement can be prepared.

DEVELOPMENT OF RESTORATION COMPONENTS

Development of the Restoration Project has been consistent with CALFED and the CVPIA ecosystem restoration concepts, such as replacement of ecologically equivalent habitat; protection and restoration of natural channel and riparian habitat values; promotion of natural processes that regulate geomorphic characteristics, nutrient dynamics, and production capabilities; improvement of ecological functions to support sustainable populations of diverse plant and animal species; maintenance of appropriate seasonal patterns that will sustain important ecological systems; and ecosystem-based adaptive management (see *Background* above for more detail and citations). Restoration Project development also has been consistent with salmonid restoration principles developed by Spence et al. (1996), which include improvement of connectivity between isolated habitat patches and protection and restoration of areas surrounding critical refugia from further degradation, to allow for expansion of existing populations (Kier Associates 1999).

Instream Flow

Instream flow has been identified as the primary factor affecting spawning and rearing habitat of anadromous fish in Battle Creek, and the lack of spawning and rearing habitat has been identified as limiting the production of anadromous fish (USBR and SWRCB 2003). Because Battle Creek contains a diversity of anadromous fish species and their life stages, substantial effort has been directed toward identifying which stream reaches and minimum instream flow schedules would be best suited to the recovery of the different species and life stages of anadromous fish throughout the year.

Estimates of increased minimum flows needed to help restore anadromous fisheries in Battle Creek were initially evaluated by the Service in coordination with State and Federal agencies, stakeholders, and interested parties pursuant to the AFRP (USFWS 1997), with the objective of providing adequate holding, spawning, and rearing habitat. AFRP flow prescriptions considered relationships between streamflow and physical habitat available to various life stages of anadromous fish for several reaches of Battle Creek (Thomas R. Payne and Associates 1991), based on the Instream Flow Incremental Methodology (IFIM) and Physical Habitat Simulation (PHABSIM) system (Milhouse et al. 1984). The AFRP considered temperature and hydrology in prescribing its minimum instream flows, but a temperature model for Battle Creek was not available at that time. The AFRP flow prescriptions were offered as indicators of magnitude needed to optimize anadromous fish production, subject to revision on additional analysis (USFWS 1995), and were included in the Revised Draft Restoration Plan for the AFRP (USFWS 1997). In general, these flows were judged to be capable of developing 70 to 75 % of the estimated life stage potentially limiting to the population (USBR and SWRCB 2003).

In 1998, the BCWG biological technical team, composed of experts from resource agencies, PG&E, and stakeholders, considered additional analysis of IFIM data (Thomas R. Payne and Associates 1998a) and results of temperature modeling using the SNTEMP model (Thomas R. Payne and Associates 1998b,1998c; PG&E 2001). The analysis identified: (1) priority species and life stages of focus for each reach of Battle Creek, (2) flows to facilitate upstream access over obstacles in the stream channel, (3) rates of flow changes to avoid stranding and isolation of juveniles, and (4) water temperatures influenced both by increased flows and releases of cold spring-fed water to adjacent reaches of Battle Creek (USBR and SWRCB 2003:Appendix D). The biological technical team assessed species' limiting life stages, generally spawning or rearing, to determine appropriate minimum flows (Kier Associates 1999). Flow prescriptions developed for the limiting life stages were designed to provide approximately 95% of the estimated potential habitat that could be created by flow management. As a result, the BCWG increased the minimum flows prescribed by the AFRP and incorporated them into the Restoration Project MOU as updated flow prescriptions.

A significant feature of the BCWG-derived flow prescriptions is the release of cold spring water into Battle Creek at Eagle Canyon on the North Fork, and Soap Creek and lower Ripley Creek tributaries to the South Fork. Instream flows provided below Asbury Dam on Baldwin Creek (a tributary to the mainstem Battle Creek) would contain spring water from Darrah Springs. Release of cold spring water into the natural stream channels provides cool water habitat for anadromous salmonids. Winter-run Chinook salmon originally were obligated to streams like Battle Creek having reaches with stable instream flow and temperature during summer, largely derived from cold-water springs (USFWS 1963). Battle Creek historically supported populations of winter-run Chinook salmon, but at present, the only other population occurs in the main stem Sacramento River below Shasta Dam, where cool water releases from the deepest portion of Shasta Lake provide suitable temperatures (Kier Associates 1999). However, the Sacramento River population is at risk of total reproductive failure due to lethal water temperatures at least 2 years out of 100, and partial reproductive failure 1 year out of 10 (USBR 1991). Spring water releases on Battle Creek would help provide drought resistant refugia and help spread the risk of reproductive failures of the Sacramento River winter-run population.

During some periods of the year, the needs of anadromous fish species and lifestages can conflict (Kier Associates 1999). Some accommodation is possible through short-term minimum flow adjustments that serve the needs of all species-life stages fairly well, but the adjustments might not be optimal for any particular species-life stage. The declining priority of species consideration used by the biological technical team was winter-run Chinook salmon, spring-run Chinook salmon, steelhead, late fall–run Chinook salmon, and fall-run Chinook salmon, based on the inability of scarce available habitat in this watershed, and elsewhere, to meet the needs for natural reproduction of the species and to effect their recovery (USBR and SWRCB 2003). Whereas, the greatest divergence of seasonal flow needs occurs between steelhead and the various runs of Chinook salmon, steelhead have greater opportunities available to them for suitable habitat elsewhere in the upper Sacramento River basin; thus the biological technical team's decision to provide a less-than optimal flow regime for steelhead ensures that habitat conditions for winter- and/or spring-run Chinook salmon are given priority.

Another important consideration for determining appropriate minimum flows in some stream reaches was passage over natural barriers (Kier Associates 1999), as discussed below under *Fish Passage*. In some cases, ensuring this passage required elevating flows to higher levels than optimal for other life stages. But typically, even with this passage accommodation, the minimum flows recommended by the biological technical team could achieve 95% or more of the estimated potential habitat for a limiting life stage.

Fish Passage

The cross-basin transfer of North Fork Battle Creek water to two powerhouses on the South Fork and then into the South Fork channel results in mixing of North Fork and South Fork water.

Inter-basin mixing of water could adversely affect migration of adult salmon and steelhead to their natal streams a phenomenon known as false attraction (Kier Associates 1999).

One aspect of false attraction is the confounding of olfactory cues that help guide migrating adults to their natal habitat for spawning. Olfactory cues are unique to each stream and inter-basin mixing of Battle Creek water could falsely attract fish to the wrong fork. For example, migrating winter- and spring-run Chinook salmon returning to North Fork Battle Creek may be drawn into the South Fork Battle Creek after sensing North Fork water mixed with South Fork water. During drought, South Fork Battle Creek is considered less desirable to winter- and spring-run Chinook salmon natal to the North Fork, because the South Fork would have limited capabilities to produce spring- and winter-run Chinook salmon, except in the higher elevation reaches. The North Fork, with its abundant cold water springs, has higher resistance to drought conditions.

Maintaining the fidelity of fish natal to the North Fork might help ensure survival of winter- and spring run Chinook salmon populations during adverse stream conditions elsewhere in the Sacramento River basin. Guarding against false attraction might prevent the South Fork from becoming a drain on winter- and spring-run Chinook salmon populations produced in the North Fork, and the important North Fork drought refugia from being under-seeded during a drought. Should false attraction limit the rate and/or size of population growth in the North Fork, fewer returning adults would subsequently return to seed this refugia. Although lacking the North Fork’s level of drought refugia, South Fork Battle Creek is still very desirable to restore for anadromous fish, as it has the largest capacity to produce Chinook salmon outside of drought years.

A second aspect of false attraction involves powerhouse discharges of relatively large amounts of cool water into the stream at their tailraces (Kier Associates 1999). Under natural conditions, water temperatures typically become cooler upstream. Adult fish migrating upstream key on declining temperature as they seek habitats with cooler water conducive to successful spawning and rearing. This natural temperature profile is interrupted where powerhouse discharges enter the South Fork Battle Creek. Localized zones of cooler water might cause adult fish to arrest upstream movement too early and spawn in those zones. Planned or unplanned powerhouse outages or other disruptions of normal powerhouse discharges above those zones could then result in stream temperatures above the maximum threshold for salmonid eggs or fry. Although confined to South Fork Battle Creek, this situation is important because the natural cool water habitat needed to restore spring-run Chinook salmon and steelhead are located at distant upstream reaches of this fork (USBR and SWRCB 2003). Interrupting the spawning migration to upstream habitat could compromise the recovery of naturally producing spring-run Chinook salmon and steelhead populations in South Fork Battle Creek.

The BCWG biological technical team determined that false attraction might be avoided by constructing conveyance facilities designed to avoid introducing North Fork Battle Creek water into the South Fork. The mixed North Fork and South Fork water within the Hydroelectric Project’s water conveyance system would not enter Battle Creek until about 5 miles downstream of the forks' confluence, where the waters are already naturally mixed. Tailrace connectors at South and Inskip Powerhouses and a water bypass feature at Inskip Powerhouse would convey mixed water to Coleman Canal instead of discharging it into South Fork Battle Creek.

Another key consideration in restoring anadromous fish habitat is ensuring upstream and downstream passage beyond both natural barriers and artificial barriers such as dams. Natural barrier passage was addressed by the biological technical team's assessment of minimum instream flow requirements, primarily for adult fish migrating upstream to spawning and holding areas (Kier Associates 1999). Some natural barriers would need to be modified to improve passage conditions at prescribed flows and, because the stream is a dynamic environment and floods may create new natural barriers, monitoring for these occurrences should be performed regularly. Appropriate action would be needed to modify a new barrier or adjust instream flows to improve passage.

The Restoration Project addressed fish passage at Hydroelectric Project facilities with new fish ladders and screens. The MOU Parties determined that the fish screens and ladders would be "failsafe." Failsafe ladders must have "features inherent in the design of the ladder that ensure the structure will continue to operate to facilitate the safe passage of fish under the same performance criteria as designed under anticipated possible sources of failure" (MOU Parties 1999). Failsafe screens must be "designed to automatically shut off the water diversion whenever the fish screen fails to meet design or performance criteria until the fish screen is functioning again."

Ladders and screens were otherwise designed to be state-of-the-art installations (USBR and SWRCB 2003). Ladders incorporated resource agency design recommendations (SWRCB 2000), with particular attention toward providing attraction flows throughout the range of instream flows needed by adult fish to move upstream. Ladder configurations known to provide reliable performance in the field would be used, and would allow for flow adjustment during abnormally low water conditions to ensure that effective passage conditions are maintained. Protective structures to minimize the potential for damage during floods would be included. The conservative design approach of ladders, coupled with the relatively low heights of dams, are expected to provide high passage reliability. Fish screen designs incorporated fish screen criteria from NOAA Fisheries (NMFS 1997a) and CDFG (CDFG 1997). These criteria would help minimize the entrainment of out-migrating juvenile fish into Hydroelectric Project water conveyance facilities. In cases where diversion dams would no longer be needed by the Hydroelectric Project because of reduced diversions to increase instream flows, removal of dams at those sites would eliminate any concerns about fish passage.

Stream Function

The Hydroelectric Project's system of canals and/or powerhouses is subject to planned and unplanned outages, during which time water that cannot be conveyed through powerhouses or canals is released to the natural stream channel at any of the various spill outlets at the dams or along the canals (USBR and SWRCB 2003). Although routine outages are scheduled during high flow periods, the amount of water released from the hydroelectric system during unplanned outages is up to five times the minimum amount released to the stream for fish. These flows of several hundred cubic feet per second added to the creek during minimum flow conditions, followed by their removal after the outage period, disrupts the stability of the stream. Rapid flow fluctuation in natural stream channels can adversely affect aquatic organisms through abnormal changes in water temperature, and fish that move into temporarily wetted habitat areas could be stranded when flows rapidly return to normal. Similarly, spawning redds that are established in transitory habitat are de-watered as instream flows recede (Kier Associates 1999). Effects on stream function are more widespread the farther upstream the spill of hydroelectric system waters occurs (although the spill is generally released as far downstream as possible to reduce the affects on the stream environment) (USBR and SWRCB 2003).

Installation of tailrace facilities would address flow fluctuation issues, such as rapid temperature change and shifts is wetted habitat area. Flow fluctuations associated with hydroelectric system operations would be contained within the Hydroelectric Project's conveyance features, rather than causing disruptions in the natural stream channels. Minimizing flow fluctuations from both planned and unplanned hydroelectric system outages also was addressed by the Restoration Project through improved ramping rates, which would allow large flow changes to occur more gradually.

Adaptive Management

Because determining the effectiveness of Restoration Project actions would require monitoring population levels and habitat use, and unanticipated factors could affect fishery restoration results, adaptive management would be useful as a tool to monitor initial results and refine actions being taken. Adaptive management is defined by the Restoration Project as a formal, well-defined, science-based process to identify goals, parameters to be monitored, protocols for data assessment, trigger points to initiate action, and adaptive actions to be taken. The pattern would continually cycle with the goal of achieving restoration objectives (USBR and SWRCB 2003). Initial restoration actions would be comprehensive and based on the best scientific information available. Adaptive management would continually refine initial actions, based on monitoring and acquisition of fishery response data and/or improved scientific information.

Timeliness

The Restoration Project enables timely restoration of the stream compared with waiting until 2026 for expiration of the existing FERC license of the Battle Creek Hydroelectric Project (USBR and SWRCB 2003). Timely restoration of a drought resistant, spring-fed system like Battle Creek is especially important to recovery of species such as winter- and spring-run Chinook salmon and steelhead, which are dependant on cool-water stream habitats. The populations of these species/runs are presently at risk throughout the Central Valley, and no other Central Valley stream has the restoration potential for these species/runs as that of Battle Creek (Kier Associates 1999).

PROJECT DESCRIPTION

The Proposed Action and alternatives, as described in the Draft EIS/EIR (USBR and SWRCB 2003), were developed to restore the ecological processes that would allow recovery of Chinook salmon and steelhead populations in Battle Creek and minimize the loss of electrical power produced by the Hydroelectric Project. Restoration components focus on providing increased amounts and quality of spawning and rearing habitat (which are limiting salmon and steelhead production in Battle Creek), unimpeded passage past natural and Hydroelectric Project barriers to preferred habitats, appropriate water temperatures and temperature continuity, and unambiguous environmental cues used by salmon and steelhead to navigate (USBR and SWRCB 2003). A summary of restoration options and their purposes are summarized in Table 2.

Variations and different combinations of restoration options (Table 2) were synthesized into four action alternatives (Table 3), which were named by the number of dams that would be removed: Five-Dam Removal (Proposed Action), No-Dam Removal, Three-Dam Removal, and Six-Dam Removal. A fifth action alternative for removing all Hydroelectric Project facilities below the natural fish passage barriers on Battle Creek (except the two Volta powerhouses) was considered but eliminated because it did not meet the Purpose and Need objective of minimizing lost power production from the Hydroelectric Project. An additional alternative for no action also was developed and is used as a baseline for comparing of alternatives (Table 3).

All action alternatives include one of the two enhanced flow regimes (Table 4) for both forks of Battle Creek. Minimum flow releases below Hydroelectric Project diversion dams would vary by alternative, Hydroelectric Project facility, and month of year, depending on which enhanced flow regime applies. The first flow regime was originally proposed by the AFRP (USFWS 2001b) prior to origination of the Restoration Project. The second flow regime (Kier Associates 1999), developed by the BCWG biological technical team after additional analysis of instream flow data (Thomas R. Payne and Associates 1998a), increased the minimum flows prescribed by the AFRP and included cold-water releases from Eagle Canyon and Bluff springs.

Proposed Action

The Proposed Action (Five Dam Removal Alternative) was developed through a collaborative process involving resource agencies, PG&E, and Battle Creek stakeholders, and was originally described in the Restoration Project MOU (MOU Parties 1999). Primary physical components, including fish screens and ladders, tailrace connectors, and powerhouse bypasses, are listed for each Hydroelectric Project facility (Table 3). The Proposed Action incorporates enhanced stream flows per the BCWG flow regime (Table 4) effectuated by increased releases at diversion dams and releases of all spring water at Eagle Canyon Diversion Dam, Bluff and Soap Creek basins, and Darrah/Baldwin Creek Basin. Release of spring water is intended to provide cold water refugia for fish, and is a component unique to the Proposed Action. Other unique components, stipulated per the Restoration Project MOU, include provision of flows below lower Ripley and Soap creek diversions, transfer of water rights associated with removed dams from PG&E to CDFG for instream uses, a funded adaptive management plan (AMP) (Kier Associates 2001), and funding for additional water needs that may be identified in the future based on monitoring and adaptive management (USBR and SWRCB 2003).

Table 2. Summary of restoration options and their purposes considered in developing alternatives for the Battle Creek Salmon and Steelhead Restoration Project.

Restoration Option	Restoration Purpose
Increase flow releases at diversion dams and release flows at natural springs	Increase quality and quantity of instream habitat, including improved water temperature conditions; facilitate fish passage at natural and Hydroelectric Project barriers
Construct fish screens	Facilitate juvenile fish passage past diversion intakes
Construct fish ladders	Facilitate adult fish passage past diversion dams
Construct tailrace connectors	Discontinue mixing of North Fork and South Fork water in South Fork; stabilize water flow and temperature in South Fork
Construct powerhouse bypass	Discontinue mixing of North Fork and South Fork water in South Fork; stabilize water flow and temperature in South Fork
Remove diversion dams and appurtenant facilities	Facilitate fish passage past diversion dams no longer needed for hydropower production under modified flow regimes
Re-operate Asbury dam	Increase quality and quantity of instream habitat, including improved water temperature conditions
Provide ramping rates for flow release changes at dams	Eliminate abnormally rapid flow fluctuations in the natural stream channels associated with Hydroelectric Project operation
Rededicate instream water rights to instream uses	Increase quality and quantity of instream habitat, including improved water temperature conditions
Establish and implement ecosystem-based Adaptive Management Plan (AMP)	Identify and implement changes to restoration strategies and actions needed to achieve long-term biological goals of Restoration Project based on monitoring and research
Establish adaptive management fund	Provide readily available funding for potential future changes to restoration strategies and actions under AMP
Establish water acquisition fund	Purchase future additional instream flows, as needed, through AMP
Establish and implement Facility Monitoring and Maintenance Plan	Monitor effectiveness of new facilities and maintain to ensure proper function

Table 3. Summary of restoration components included in each alternative of the Battle Creek Salmon and Steelhead Restoration Project (adapted from USBR and SWRCB 2003).

Restoration Project Component	Alternative[1, 2]				
	NA	5D	ND	6D	3D
Remove Eagle Canyon Diversion Dam & appurtenant facilities				✔	✔
Remove Wildcat Diversion Dam & appurtenant facilities		✔		✔	✔
Remove South Diversion Dam & appurtenant facilities		✔		✔	
Remove Coleman Diversion Dam & appurtenant facilities		✔		✔	✔
Remove Soap Creek Diversion Dam & appurtenant facilities		✔		✔	
Remove lower Ripley Creek Diversion Dam & appurtenant facilities		✔		✔	
Construct Inskip penstock bypass pipeline/chute		✔		✔	
Construct tailrace channel separator between South Powerhouse & Inskip Canal		✔		✔	✓
Construct tailrace connector between Inskip Powerhouse & Coleman Canal		✔		✔	✔
Construct North Battle Creek Feeder Diversion Dam fish screen and fish ladder		✔	✔	✔	✔
Construct Eagle Canyon Diversion Dam fish screen and fish ladder		✔	✔		
Construct Wildcat Diversion Dam fish screen and fish ladder			✔		
Construct South Diversion Dam fish screen and fish ladder			✔		✔
Construct Inskip Diversion Dam fish screen and fish ladder		✔	✔	✔	✔
Construct Coleman Diversion Dam fish screen and fish ladder			✔		
Increase releases at all Battle Creek dams not removed to levels per MOU		✔		✔	
Increase releases at all Battle Creek dams not removed to levels per AFRP			✔		✔
Release flows of cold natural springs into creeks		✔		✔	✓
Provide water below dam sites on Soap and lower Ripley Creeks		✔		✔	
Reoperate and gage Asbury Diversion Dam; provide water below dam		✔		✔	✔
Screen and ladder designs meet failsafe definition in MOU		✔	✔	✔	✔
Maintain and replace, as needed, all fish ladders on dams	✔	✔	✔	✔	✔
Provide improved ramping rates for flow release changes at dams (0.1 ft/hr)		✔	✔	✔	✔
Rededicate instream water rights to instream uses		✔			
Establish and implement ecosystem-based Adaptive Management Plan (AMP)		✔	✓	✓	✓
Establish adaptive management fund and water acquisition fund		✔			

[1]Small checkmark (✓) indicates design/plan is less environmentally beneficial than design with large checkmark (✔).
[2]NA=No Action, 5D=Five-Dam Removal, ND=No Dam Removal, 6D=Six-Dam Removal, 3D=Three-Dam Removal.

Table 4. Minimum instream flow releases developed by the Anadromous Fish Restoration Program (AFRP) and Battle Creek Working Group (BCWG) for the Battle Creek Salmon and Steelhead Restoration Project (adapted from USBR and SWRCB 2003).

Diversion Dam	Monthly Minimum Flow Release (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North Battle Creek Feeder												
AFRP	40	40	40	40	30	30	30	30	40	40	40	40
BCWG	88	88	88	67	47	47	47	47	47	47	47	88
Eagle Canyon												
AFRP	50	50	50	50	30	30	30	30	30	30	30	50
BCWG	46	46	46	46	35	35	35	35	35	35	35	46
Wildcat												
AFRP	50	50	50	50	30	30	30	30	30	30	30	50
BCWG	Facility Removed for all applicable alternatives; no instream flow requirement											
South												
AFRP	30	30	30	30	20	20	20	20	20	20	20	30
BCWG	Facility Removed for all applicable alternatives; no instream flow requirement											
Inskip												
AFRP	40	40	40	40	30	30	30	30	30	30	30	40
BCWG	86	86	86	61	40	40	40	40	40	40	40	86
Coleman												
AFRP	50	50	50	50	30	30	30	30	50	50	50	50
BCWG	Facility Removed for all applicable alternatives; no instream flow requirement											

The AMP was developed pursuant to the Restoration Project MOU (MOU Parties 1999), and presently is in draft form (Kier Associates 2001). Adaptive management was defined as a multi-agency team procedure that: "(1) uses monitoring and research to identify and define problems; (2) examines various alternative strategies and actions for meeting measurable biological goals and objectives; and (3) if necessary, makes timely adjustments to strategies and actions based upon best scientific and commercial information available" (MOU Parties 1999). The goal of the AMP is to implement specific actions to protect, restore, enhance, and monitor salmonid habitat, guard against false attraction of adult migrants, and ensure that Chinook salmon and steelhead are able to fully access and utilize available habitat in a manner that benefits all life stages and thereby maximizes natural production, fully utilizing ecosystem carrying capacity (MOU Parties 1999). The draft AMP includes dedicated funding sources, notably a $3 million third party contribution to facilitate any additional Hydroelectric Project facility modifications or acquisition of additional water to meet instream needs (USBR and SWRCB 2003).

No-Dam Removal Alternative
The No-Dam Removal Alternative reflects the view of resource agencies in the early 1990's that successful restoration of anadromous fish habitat on Battle Creek could be achieved by increasing flow releases at Hydroelectric Project diversion dams and installing new fish ladders and screens. This view was embodied in the Revised Draft Restoration Plan for the AFRP (USFWS 1997), which included the AFRP's enhanced flow prescriptions (Table 4). In the Restoration Project Draft EIS/EIR, the No-Dam Removal Alternative represents a lower-cost restoration approach that would not include removal of diversion dams, higher levels of lost hydroelectric power production, and other cost-invoking provisions and funding for additional environmental enhancements and water management (Table 3).

Six-Dam Removal Alternative
The Six-Dam Removal Alternative was developed in response to recommendations from the public to remove Eagle Canyon Dam in addition to removal of those identified in the Five-Dam Removal Alternative. Removal of Eagle Canyon Dam was proposed primarily as a benefit to anadromous fish migration. All other facility modifications of the Five-Dam Removal Alternative also would be included (Table 3). The instream flow regime would follow BCWG prescriptions (Table 4).

Three-Dam Removal Alternative
The Three-Dam Removal Alternative was developed in response to habitat needs of the endangered winter-run Chinook salmon. NOAA Fisheries' proposed recovery plan for Sacramento River winter-run Chinook salmon (NMFS 1997b) identified Battle Creek as a stream for potential recovery efforts through re-operation of the Hydroelectric Project, which could provide sufficient cold water flows during summer months for winter-run spawning and rearing, even during drought years. The three dams that would be removed are the first encountered by migrating salmon on the North Fork (Wildcat and Eagle Canyon diversion dams) and South Fork (Coleman Diversion Dam) Battle Creek (Table 3), and their removal was considered beneficial for winter-run to gain access to spawning and rearing habitat upstream (USBR and SWRCB 2001). The Three-Dam Removal Alternative would adopt the AFRP enhanced flow regime (Table 4) and a tailrace channel separator designed for normal creek flow conditions (50-year

flood would overtop and allow South Fork and North Fork water to mix) would help stabilize instream conditions (Table 3). Removal of Soap and Lower Ripley diversion dams is not included, but water would be released from Asbury Dam on Baldwin Creek.

No Action Alternative
The No Action Alternative represents Hydroelectric Project facility operations consistent with the existing FERC license, which expires in 2026. The interim agreement and its provisions for habitat benefits would no longer be in effect. Minimum flow releases below diversion dams would be 3 cfs on the North Fork and 5 cfs on the South Fork. No fish passage and/or flow provisions would exist for Ripley, Soap, or Baldwin Creeks. Existing fish ladders would be maintained and operated in accordance with existing FERC license requirements for the Hydroelectric Project.

BIOLOGICAL RESOURCES

Fisheries and Aquatic Resources
Aquatic Habitats and Species
North Fork Battle Creek has runoff flows supplemented by large amounts of spring water that emerge along its banks. Both forks contain steadily flowing water through deep, often shaded, gorges and maintain relatively high, cold flows, even during dry seasons. Each fork usually contains about 50 percent of total creek flow (USBR and SWRCB 2003). In winter, however, South Fork Battle Creek may have as much as 75 percent of total flow, while North Fork Battle Creek flows are more dominant in fall.

An important component of Battle Creek habitat is shaded riverine aquatic (SRA) cover, which is defined as the unique, near shore aquatic area occurring at the interface between a stream and adjacent woody riparian habitat (USFWS 1992). Key attributes of this aquatic area include the adjacent bank being composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water. The water contains variable amounts of woody debris, such as leaves, logs, branches and roots, and often substantial detritus. Often, much of the instream cover consists of dead woody debris that has fallen from the overhanging riparian vegetation, but whole trees, which periodically become dislodged from adjacent banks, often contribute to SRA cover.

The anadromous salmonid fishery in Battle Creek comprises four runs (spring-run, fall-run, late-fall-run, and winter-run) of Chinook salmon and the steelhead trout. Life history patterns and the general timing of Chinook salmon and steelhead runs in Battle Creek result in at least one life stage of all runs of Chinook and steelhead being present during all months of the year (Kier Associates 1999: Table 2). Both naturally produced and hatchery raised anadromous salmonids exist in Battle Creek. Naturally produced fish include steelhead and all four runs of Chinook, whereas, CNFH-produced fish include steelhead, fall-run Chinook, and late-fall-run Chinook. The Pacific lamprey is the only other anadromous species known to occur in Battle Creek, but its abundance and distribution in Battle Creek is unknown.

At least 12 species of resident (non-anadromous) fish occur in Battle Creek (Kier Associates 1999), which either spend their lives in Battle Creek or move from Battle Creek into tributaries or the Sacramento River. Of these 12 species, eight are native to the Sacramento River Basin; including rainbow trout (*Oncorhynchus mykiss*), pike minnow (*Ptychocheilus grandis*), Sacramento sucker (*Catostomus occidentalis*), California roach (*Hesperoleucus symmetricus*), riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), hardhead (*Mylopharodon conocephalus*), three-spine stickleback (*Gasterosteus aculeatus*), and tule perch (*Hysterocarpus traski*); and four are species that were introduced into the Sacramento River Basin, including brown trout (*Salmo trutta*), smallmouth bass (*Micropterus dolomieui*), green sunfish (*Lepomis cyanellus*), and golden shiner (*Notemigonus crysoleucas*). Other important aquatic organisms include benthic macroinvertebrates and periphyton.

Existing Conditions

Hydroelectric power development and hatchery operations on Battle Creek have affected annual runs of naturally produced Chinook salmon and steelhead trout (Kier Associates 1999). Inadequate instream flows and impaired fish passage are the primary factors. Inadequate instream flows can result in warming of water, which is harmful to fish populations when temperatures exceed biological tolerances. Inadequate instream flows also result in less wetted area in the stream channel and, thus, reduced quantity of habitat.

Fish passage is affected primarily by presence of Hydroelectric Project diversion dams with inadequate fish ladders, which can block or inhibit fish from passing upstream, and unscreened intakes, which can entrain rearing and downstream-migrating juvenile fish into Hydroelectric Project canals. Impaired passage over natural barriers in the stream channel also can occur during periods of low instream flow, such as those resulting from Hydroelectric Project diversions.

Planned and unplanned outages of the Hydroelectric Project's conveyance facilities and powerhouses, generally due to changes in power generation at powerhouses, emergency powerhouse shutdowns, and powerhouse and canal maintenance, require that water from the conveyance system be released into Battle Creek (Kier Associates 1999). These releases and their subsequent removal produce unnaturally rapid fluctuations in instream flows, resulting in wetted area and water temperatures changes that can be detrimental to some lifestages of anadromous fish (USBR and SWRCB 2003). Moreover, transfer of North Fork water to the South Fork for hydroelectric power generation results in abnormal mixing of North Fork and South Fork water. Mixing of waters from North Fork and South Fork Battle Creek is thought to confound olfactory cues and water temperature gradients that lead migrating adult fish to their proper spawning areas (i.e., false attraction), thus increasing the risk of unsuccessful or less successful reproduction (USBR and SWRCB 2003).

It is likely that resident fish species also have been affected by disrupted ecosystem processes within Battle Creek, such as reductions and fluctuations in instream flow (USBR 1998), changes in temperature regimes, entrainment of fish into the Hydroelectric Project canals, and disruption of fish movements caused by dams.

In consideration of the unique aquatic habitat conditions of Battle Creek and the creek's high ecological value for fall- and late fall-run Chinook salmon,[2] the Service has designated Battle Creek riverine habitat as Resource Category 2.

Upland Resources

Upland habitats common to the project area comprise native and naturalized habitats including annual grassland, mixed chaparral, live oak woodland, blue oak woodland/savanna, gray pine/oak woodland, westside ponderosa pine (Table 5). The following descriptions of upland habitats and wildlife observed on the project area, or typically associated with these habitats in this part of the Sierra Nevada foothills, is derived primarily from field surveys conducted from 2000 to 2002 (JSA 2001a, 2001b, 2001c; JSA 2002a, 2002b).

Annual Grassland

Annual grassland is the most common plant community on the project area and comprises mostly nonnative annual grass species, such as bromes (*Bromus* spp.), annual fescues (*Festuca* spp.), and Italian rye-grass (*Lolium multiflorum*). Nonnative forbs include filarees (Erodium sp.), yellow star-thistle (*Centaurea solstitialis*), and prickly lettuce (*Lactuca serriola*). Native forbs include (goldfields (Lasthenia spp), yellowcarpet (*Blennosperma nanum*), and popcorn-flower (*plagiobothrys* sp). Annual grassland provides habitat primarily for relatively common wildlife species, such as the gopher snake (*Pituophis melanoleucus*), western fence lizard (*Sceloporus occidentalis*), western king bird (*Tyranus verticalis*), horned lark (*Eremophilia alpestris*), red-tailed hawk (*Buteo jamaicensis*), California vole (*Microtus californicus*), and black-tailed deer (*Odocoileus hemionus*). Annual grassland is abundant on the project area and is associated with mostly common wildlife species, but also provides important habitat to native species using or requiring open space, such as raptors, horned lark, and California vole); therefore, the Service has designated annual grassland as Resource Category 3.

Mixed Chaparral

Mixed chaparral also is common on the project area and comprises primarily broad-leaved, sclerophyll shrubs, such as buckbrush (*Ceanothus cuneatus*), manzanita (*Arctostaphylos* spp.), and coffeeberry (*Rhamnus tomentella*). Typical wildlife of mixed chaparral include the gopher snake, western fence lizard, California quail (*Callipepla californica*), spotted towhee (*Pipilo maculatus*), lesser goldfinch (*Carduelis psaltria*), black-tailed deer, and gray fox (*Urocyon cinereoargenteus*). Neotropical migrant birds include the western tanager (*Piranga ludoviciana*) and orange-crowned warbler (*Vermivora ruficapilla*), among others. Mixed chaparral is relatively abundant on the project area and is associated with many common wildlife species, but also provides habitat to important native species, such as neotropical migrant birds; therefore, the Service has designated mixed chaparral as Resource Category 3.

Live Oak Woodland

Live Oak woodland is common on the project area, primarily in canyons and valley bottoms near streams. Predominant plant species are canyon and interior live oak *(Quercus chrysolepis* and *Q.*

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[2]The Mitigation Policy does not apply to species listed or proposed for listing under the ESA, including spring- and winter-run Chinook salmon and steelhead.

Table 5. Plant communities and associated wildlife habitats observed at project sites[1] (JSA 2001a).

Project Site	Annual Grassland	Mixed Chaparral	Live Oak Woodland	Blue Oak Woodland/ Savanna	Grey Pine/Oak Woodland	Westside Ponderosa Pine Forest	Emergent Wetland	Seasonal Wetland	Emergent Scrub Wetland	Groundwater Seep	Riparian Forest/ Riparian Scrub
North Battle Creek Feeder Diversion Dam			X		X	X					X
Eagle Canyon Diversion Dam			X							X	X
Wildcat Diversion Dam/ Wildcat Pipeline	X	X		X							X
Coleman Diversion Dam/ Inskip Powerhouse[2]	X		X	X	X		X	X	X		X
Lower Ripley Creek Feeder	X			X							X
Inskip Diversion Dam/ South Powerhouse	X		X				X	X			X
Soap Creek Feeder	X	X	X	X	X						X
South Diversion Dam/ South Battle Creek Canal		X			X						X

[1] Does not include plant communities and associated wildlife habitats observed in existing access roads or potential staging areas.
[2] The Coleman Diversion Dam/Inskip Powerhouse project site also includes plant community and associated wildlife habitat observations at the Penstock Junction Box.

wislizenii) with other species, such as California bay (*Umbellularia californica*), buckeye (*Aesculus californica*), and black oak (*Q. kelloggii*), also usually present. Wildlife inhabiting live oak woodland include the western rattlesnake, northern alligator lizard (*Gerrhonotus coeruleus*), American kestrel (*Falco sparverius*), western screech owl (Otus kennicottii), California towhee (*P. crissalis*), ringtail (*Bassariscus astutus*), and bobcat (*Lynx rufus*). Neotropical migrant birds include Pacific-slope flycatcher (*Empidonax difficilis*), blue-gray gnatcatcher (*Polioptila caerulea*), and lazuli bunting (*Passerina amoena*). Acorns produced by oaks are a major food source for many wildlife species, such as the California quail, wild turkey (*Meleagris gallopavo*), acorn woodpecker (*Melanerpes formicivorus*), and western gray squirrel (*Sciurus griseus*) (McDonald 1988). Because live oaks species are slow growing and long lived, are associated with ecologically valuable riparian woodland in canyon corridors, and acorns are an important food for many wildlife species, the Service has designated this habitat as Resource Category 2.

Blue Oak Woodland/Savanna

Blue oak woodland/savanna occurs on the project area where soils are relatively thin and rocky. This type is composed predominantly of blue oaks (*Q. douglasii*). Shrubs are generally lacking except for occasional chaparral species. Representative wildlife species include the gopher snake, western fence lizard, barn owl (*Tyto alba*), greater roadrunner (*Geococcyx californicus*), white-breasted nuthatch (*Sitta carolinensis*), ringtail, and coyote (*Canis latrans*). Neotropical migrant birds include ash-throated flycatcher (*Myiarchis cinerascens*), blue-gray gnatcatcher, and orange-crowned warbler. As in live oak woodland, several wildlife species in blue oak woodland benefit from acorns as a food source (Schoenherr 1992:95), including the acorn woodpecker, wild turkey, western scrub jay (*Alphelocoma californica*), and western gray squirrel. Because blue oak is a slow growing and long lived species and is not regenerating in many parts of its range (Schoenherr 1992:95-96), and acorns are an important food for many wildlife species, the Service has designated this habitat as Resource Category 2.

Gray Pine/Oak Woodland

Gray pine/oak woodland is common on the project area and comprises primarily a mixture of blue oak and gray pine (*Pinus sabiniani*) with inclusions of mixed chaparral as understory. Gray pine/oak woodland transitions into blue oak woodland at lower elevations and westside ponderosa pine forest at higher elevations and, consequently, wildlife species inhabiting gray pine/oak woodland resemble those found in the other two habitats. Because of the blue oak component of gray pine/oak woodland and the associated biological values of oaks, as described above, the Service has designated this habitat as Resource Category 2.

Westside Ponderosa Pine Forest

Westside ponderosa pine forest occurs at higher elevations in the southern end of the project area. This habitat comprises primarily ponderosa pine with lesser amounts of incense cedar, black oak, and canyon live oak. Associated shrub species may include manzanita, live oak, and coffeeberry. Representative wildlife include the common kingsnake (*Lampropeltis getulus*), California slender salamander (*Batrachoseps attenuatus*), sharp-shinned hawk (*Accipiter striatus*), northern pygmy owl (*Glaucidium gnoma*), hairy woodpecker (*Picoides villosus*), deer mouse (*Peromyscus maniculatus*), racoon (*Procyon lotor*), and bobcat. Representative neotropical migrant birds include olive-sided flycatcher (*Contopus cooperi*), warbling vireo (*Vireo gilvus*), and western tanager (*Piranga ludoviciana*). Because westside ponderosa pine forest is common in the region, provides moderate biological values, and is not particularly difficult to regenerate or slow to mature, the Service has designated this habitat as Resource Category 3.

Existing Conditions
Upland resources in the Restoration Project area appear to be in relatively good condition. Predominance of private land and steep terrain have helped minimize land development and existing land uses have had less impact in the Battle Creek watershed than in other watersheds (Kier Associates1999). Hydroelectric power development has affected upland resources little since development of the hydroelectric facilities. Most effects on upland habitat probably are derived from land uses such as livestock grazing and timber cutting.

Wetland Resources
Wetlands on the Restoration Project area include emergent wetland, seasonal wetland, emergent scrub wetland, groundwater seep, and riparian forest/riparian scrub[3] (Table 5). The following descriptions of wetland habitats and wildlife observed on the project area, or typically associated with these habitats in this part of the Sierra Nevada foothills, are derived primarily from field surveys and reports contracted by Reclamation (JSA 2001a, 2001b, 2001c).

Emergent Wetland
Emergent wetlands on the project area are characterized primarily by perennial, herbaceous hydrophytes, such as narrow-leaved cattail (*Typha angustifolia*), Pacific rush *(Juncus effusus*), tall cyperus (*Cyperus eragrostis*), and monkeyflower (*Mimulus guttatus*). Shrubs are less common, but may include sandbar willow (*Salix exigua*) and Himalayan blackberry (*Rubus discolor*). Emergent wetlands in the region are particularly important habitat for amphibians and water associated reptiles, such as California newt (*Taricha torosa*), Sierra Nevada salamander (*Ensatina eschscholtzi*), northwestern pond turtle (*Clemmys marmorata marmorata*), and garter snakes (*Thamnophis* spp.). Wetland associated birds include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), various ducks and geese (Anatidae), greater yellowlegs (*Tringa melanoleuca*), and common snipe (*Gallinago gallinago*). Many mammals use emergent wetlands for foraging and drinking water. Because emergent wetlands provide essential habitat for a large diversity of wildlife species, are relatively scarce on the project area, and are generally declining in abundance in California, the Service has designated this habitat as Resource Category 2.

Seasonal Wetland
Seasonal wetlands on the project area result from short duration ponding sufficient to support hydrophytic plants, and generally occur at the margins of drainages, roads, and groundwater seeps. Associated plant species include Italian ryegrass (*Lolium multiflorum*), hyssop loosestrife (*Lythrum hyssopifolium*), and sedges (*Carex* spp.). The assemblage of wildlife species associated

[3]The Service defines habitats as wetlands if they have one or more wetland characteristic (i.e., hydric soils, hydrophytic vegetation, or hydrologic conditions).

with seasonal wetlands is similar to that associated with emergent wetlands. Because seasonal wetlands provide essential habitat for a large diversity of wildlife species, are relatively scarce on the project area, and are generally declining in abundance in California, the Service has designated this habitat as Resource Category 2.

Emergent Scrub Wetland

Emergent scrub wetlands on the project area comprise plant species similar to those occurring in emergent wetlands, but with a large proportion of shrub species, such as willows (*Salix* spp.) and white alder (*Alnus rhombifolia*). Characteristic wildlife species are similar to those described for emergent and seasonal wetlands. Because emergent scrub wetlands provide essential habitat for a large diversity of wildlife species, are relatively scarce on the project area, and are generally declining in abundance in California, the Service has designated this habitat as Resource Category 2.

Groundwater Seep

This wetland type is associated with steep canyons and slopes, and is characterized by saturated soils, especially early in the plant growing season. Predominant plants are annual and perennial hydrophytes, such as sedges, hyssop loosestrife, monkeyflower, watercress (*Rorripa nasturtium-aquatica*), Tinker's-penny (*Hypericum anagalloides*), and Bryophytes. Representative wildlife are similar to those described for the other wetland types. Because groundwater seeps provide essential habitat for a large diversity of wildlife species, and are relatively scarce on the project area, the Service has designated this habitat as Resource Category 2.

Riparian Forest and Scrub

Riparian forest and scrub habitats occur along edges of Battle Creek, Ripley Creek, Soap Creek, several unnamed drainages, and within some emergent wetlands. Plant overstory species comprised by riparian forest and scrub include California bay, white alder, big-leaf maple (*Acer macrophyllum*), white mulberry (*Morus alba*), Pacific yew (*Taxus brevifolia*), and Oregon ash (*Fraxinus latifolia*). Understory species include poison oak (*Toxicodendron diversilobum*), western spicebush (*Calycanthus occidentalis*), dogwood (*Cornus sessilis*), and willow. Riparian forest and scrub often forms a mosaic with live oak woodland, and on broader floodplains, valley oak (*Quercus lobata*) and sycamore (*Platanus racemosa*) trees tend to predominate.

Riparian forest and scrub are two of the most valuable habitats on the project area. Riparian areas provide food, water, and shade for resident species of wildlife as well as other species associated with adjacent habitats. The multiple layers of riparian vegetation in association with edges of adjacent plant communities create a diverse physical structure that provides cover for a diversity of amphibians, reptiles, birds, and mammals, including the Pacific chorus frog (*Hyla regilla*), foothill yellow-legged frog (*Rana boylei*), aquatic garter snake (*Thamnophis couchi*), northwestern pond turtle, downy woodpecker (*Picoides pubescens*), black phoebe (*Sayornis nigricans*), brush rabbit (*Silvilagus bachmani)*, gray fox, and bobcat. Riparian forest and scrub provide important habitat for several species of neotropical migrant birds, such as the osprey (*Pandion haliaetus*), golden eagle (*Aquila chrysaetos*), sharp-shinned hawk, belted kingfisher (*Ceryle alcyon*), Wilson's warbler (*Wilsonia pusilla*), yellow-breasted chat (*Icteria virens*), and black-headed grosbeak (*Pheucticus melanocephalus*), and special status (Service Species of

Concern) bats (Table 1 in Attachment D). Riparian communities also function as dispersal and migration corridors for many wildlife species. Because riparian forest and scrub provide essential habitat for a large diversity of wildlife species, including neotropical migrant birds and special status bats, provide movement corridors for wildlife, and are generally declining in abundance in California, the Service has designated this habitat as Resource Category 2.

SRA cover, as described above for Fisheries and Aquatic Resources, is also important for amphibians and terrestrial wildlife that use riparian and stream edge habitat. This near shore aquatic area occurring at the stream-riparian habitat interface provides valuable resources, such as high quality food and cover (USFWS 1992). The amount of SRA cover present on Battle Creek is unknown, as it has not been inventoried. But because of the relatively small width of Battle Creek compared to the size of adjacent riparian vegetation, a high proportion of Battle Creek could probably be considered SRA cover.

Existing Conditions

Wetland resources in the Restoration Project area appear to be in relatively good condition. Predominance of private land and steep terrain have helped minimize land development and existing land uses have had less impact in the Battle Creek watershed than in other watersheds (Kier Associates 1999). Hydroelectric power development has affected wetland resources adjacent to some portions of Battle Creek through reduced minimum instream flows and operation of hydroelectric power facilities; however, the extent to which wetland habitats and species and aquatic organisms, other than fish, may be affected is not well understood in the Restoration Project area.

Reducing instream flow results in warming of water, which is harmful to wetland and aquatic organisms, such as macroinvertebrates and amphibians, if temperatures exceed biological tolerances. Less wetted area in the stream channel also can reduce quantity of aquatic and adjacent wetland and near-shore habitat used by these organisms. Reduced instream flow can affect physical processes, such as routing of sediment that is important for re-establishment of riparian vegetation and maintenance of subsurface water levels that sustain riparian vegetation. Although fine sediment, which provides suitable seed beds when deposited along stream channels, eventually is flushed downstream under existing conditions, diversion dams function as sediment traps that can affect rates and timing of sediment deposition. Maintenance of subsurface water levels are important for determining extent and growth rates of riparian vegetation. Higher levels of groundwater associated with certain channel types can be expected to support riparian vegetation farther up-slope of the stream channel, whereas, rates of instream flow can correlate with growth of riparian vegetation.

As described above for fisheries and aquatic resources, planned and unplanned outages of the Hydroelectric Project's conveyance facilities and powerhouses produce unnaturally rapid fluctuations in instream flows that can be detrimental to macroinvertebrates and amphibians. To some extent the natural hydrograph creates seasonally transitory habitat, but habitat use patterns by amphibians have evolved with the relatively predictable seasonal changes in hydrology, and the rate at which these types of flows change is generally slower than the ramping rate controlled by the dams (USBR and SWRCB 2003). During an outage, rapid increases in flow can temporarily increase water turbidity and displace riparian organisms that cannot respond quickly to changes in water elevation (Kier Associates 1999). Transitory habitat created along edges of the stream channel during an outage may remain wet long enough to be colonized by macroinvertebrates and amphibians, but when outages end, recession of flow may de-water eggs of these organisms and may not be slow enough to allow early amphibian life stages (e.g., tadpoles) or sessile macroinvertebrates to follow the receding water back to the normally wetted part of the stream (USBR and SWRCB 2003). Fluctuation in water temperature also can be detrimental to early lifestages of macroinvertebrates and amphibians.

Special Status Species

The Service provided Reclamation with an initial list of Federal special status species that may occur in the project area dated April 27, 2000, pursuant to section 7(c) of the ESA. These species included mammals, birds, amphibians, reptiles, invertebrates, and plants that are listed, or proposed to be listed, as endangered (E) or threatened (T) under the ESA, or designated as candidates or Species of Concern. When Biological Assessments are not completed within 90 days of receipt of the list, the list should be informally verified with the Service. To assist in project planning, an informal recent list is provided in Attachment A. Other special status species that may occur on the project area include those listed as endangered or threatened under CESA, designated as Species of Special Concern, listed by the California Native Plant Society, or identified as Fully Protected by the State.

Federally listed threatened and endangered species known to occur on the Restoration Project area (JSA 2001a, 2001b; USFWS 2001a; JSA 2002a, 2002b) include:

- bald eagle (Haliaeetus leucocephalus) (T)
- Central Valley steelhead (*Oncorhynchus mykiss*) (T)
- winter-run Chinook salmon (*Oncorhynchus tshawytscha*) (E)
- spring-run Chinook salmon (*Oncorhynchus tshawytscha*) (T)
- valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (T) (habitat only)

Federally listed threatened and endangered species that could exist on the Restoration Project area, as estimated by the Service (Attachment A), but not observed during surveys (JSA 2001a, 2001b, 2002a) include:

- California red-legged frog (*Rana aurora draytonii*) (T)
- vernal pool fairy shrimp (*Branchinecta lynchi*) (T)
- vernal pool tadpole shrimp (*Lepidurus packardi*) (E)
- slender Orcutt grass (*Orcuttia tenuis*) (T)

Federally listed species that occur downstream within the Sacramento River and Sacramento-San Joaquin Delta that could be affected by altered hydrology in the Sacramento River include:

- delta smelt (*Hypomesus transpacificus*) (T)
- Sacramento splittail (Pogonichthys macrolepidotus) (T)

Federal candidates known to occur on the Restoration Project area are fall/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*) (USFWS 2001a). A candidate that could exist on the Restoration Project area, as estimated by the Service (Attachment A), but not observed during surveys (JSA 2001a, 2001b) is the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

Other species that are Federal species of concern (SC), State endangered (SE), or State species of special concern (SSC) that were observed on the Restoration Project area during surveys (JSA 2001a, 2001b) were:

- foothill yellow-legged frog (*Rana boylii*) (SC, SSC)
- northwestern pond turtle (*Clemmys marmorata marmorata*) (SC, SSC)
- golden eagle (*Aquila chrysaetos*) (SSC)
- osprey (*Pandion haliaetus*) (SSC)
- Cooper's hawk (*Accipiter cooperii*) (SSC)
- sharp-shinned hawk (*Accipiter striatus*) (SSC)
- American peregrine falcon (*Falco peregrinus anatum*) (SC, SE)
- Vaux's swift (*Chaetura vauxi*) (SSC)
- little willow flycatcher (*Empidonax traillii brewsteri*) (SC, SE)
- yellow-breasted chat (*Icteria virens*) (SSC)

Many bats were observed on the Restoration Project area during general wildlife and botanical surveys (JSA 2001a, 2001b), but species could not be identified. Bat surveys were conducted at water diversion tunnels at Inskip and Eagle Canyon diversion dams and along the South Canal (JSA 2002b). The purpose was to ascertain the presence of hibernating bats and to assess the potential suitability of these tunnels for use by bats. The surveys identified an apparent big brown bat hibernating inside Inskip Tunnel 3, about 100 feet from the entrance portal. The following bat species may occur on the project area, as estimated by the Service (Attachment A):

- pale Townsend's big-eared bat (*Plecotus townsendii pallescens*) (SC, SSC)
- spotted bat (*Euderma maculatum*) (SC)
- fringed myotis bat (*Myotis thysanodes*) (SC)
- long-eared myotis bat (*Myotis evotis*) (SC)
- long-legged myotis bat (*Myotis volans*) (SC)
- small-footed myotis (*Myotis ciliolabrum*) (SC)
- Yuma myotis bat (*Myotis yumanensis*) (SC)
- pallid bat (*Antrozous pallidus*) (SSC)

Four species that are considered "plants of limited distribution," or List 4 plants, by the California Native Plant Society (CNPS) (Skinner and Pavlik 1994) were located on Restoration Project sites during field surveys (JSA 2001a, 2001b): woolly meadowfoam (*Limnanthes floccosa* ssp. *floccose*), shield-bracted monkeyflower (*Mimulus glaucescens*), depauperate milk-vetch (*Astragalus pauperculus*), and Bidwell's knotweed (*Polygonum bidwelliae*). Although considered plants of limited distribution by CNPS, they are locally common in the Restoration Project area.

Existing Conditions
Special status species in the Restoration Project area appear to be in relatively good condition, with the exception of fisheries, as described above for fisheries and aquatic resources. Habitat conditions for other special status species generally correspond to conditions of their respective habitats, as described above for upland and wetland resources. Habitat for the elderberry longhorn beetle, consisting of elderberry (*Sambucus* spp.) shrubs with stems at least 1 inch in diameter at ground level, is known to occur at some project sites.

FUTURE CONDITIONS WITHOUT THE PROJECT

Fisheries and Aquatic Resources
Without the Restoration Project, fisheries and water quality conditions within the study area would likely remain similar to those existing in the recent past prior to the interim agreement for increased instream flows; i.e., interim agreement would no longer be in effect and minimum instream flows would continue per the current FERC license (3 cfs below all North Fork Battle Creek diversions and 5 cfs below all South Fork Battle Creek diversions). These extremely low flows would continue to impair fish passage and reduce habitat quality.

Upland and Wetland Resources
Without the Restoration Project, conditions within the study area are likely to remain similar to those presently existing. Land use and habitat conversions resulting from sub-divisions of land, increased public use, water pollution, and wildfire are potential risks for wildlife and their habitats in the future (Kier Associates 1999). However, land use activities in the watershed are under review by the Battle Creek Watershed Conservancy, which has a view for watershed conservation. It is possible that future conservation measures taken in the watershed would benefit wildlife and their habitats, and help offset pressures for environmentally adverse land uses.

Special Status Species
Land subdivisions, increased public use, water pollution, and wildfire can potentially degrade habitats of special status species in the future (Kier Associates 1999). The future condition of federally listed terrestrial species without the Restoration Project probably would not be greatly degraded, as land use activities in the watershed are under review by the Battle Creek Watershed Conservancy, who has a view for listed species protection. It is possible that future conservation measures taken in the watershed would benefit these species. Future conditions without the Restoration Project for listed fish are difficult to estimate, as measures that would be taken toward recovery of listed Chinook salmon and steelhead are unknown at this time.

FUTURE CONDITIONS WITH THE PROJECT

Fisheries and Aquatic Resources
The following assessment assumes baseline conditions would be equivalent to those under the existing FERC license (i.e., without the interim agreement), which represents the NEPA baseline

(future without the project). Because the purpose of the Restoration Project is to enhance and restore anadromous fish habitat, the effects on aquatic habitat and fisheries due to the Restoration Project would largely be beneficial. However, incidental temporary and permanent impacts[4] to the aquatic ecosystem also would occur during construction.

Environmental Benefits
Probably the most fundamental component of the Restoration Project is the provision of increased instream flows in Battle Creek and its Soap Creek, lower Ripley Creek, and Baldwin Creek tributaries. The instream flow component is provided through increased releases at Hydroelectric Project diversions (i.e., amount of instream flow diverted into the Hydroelectric Project water conveyance system is reduced, leaving more flows in natural creek channels) and releases of spring water that is normally collected and diverted into Hydroelectric Project canals. Increased instream flow should provide greater habitat area, improved water temperatures, more food production and, coupled with other structural measures of the Restoration Project, should facilitate fish passage for adult and juvenile anadromous fish. Implementation of the wide array of restoration actions and achievement of the broad range of environmental benefits would constitute ecosystem-level restoration.

<u>Spawning and Rearing Habitat Capacity.</u> Based on IFIM and PHABSIM data for Chinook salmon and steelhead species-life stages (Thomas R. Payne and Associates 1998a), spawning and rearing habitat capacities (increased quantity and quality) for winter-, spring-, and late fall-run Chinook salmon and steelhead were modeled relative to minimum flow prescriptions of Restoration Project alternatives (USBR and SWRCB 2003). Results generally indicated substantially improved habitat capacities for all salmon runs and steelhead under all action alternatives, compared to the No Action Alternative (habitat capacity was not modeled for fall-run Chinook salmon because current management objectives at the Coleman National Fish Hatchery include blocking fall-run at the hatchery's barrier weir) (USBR and SWRCB 2003). Increased spawning and rearing habitat capacities for salmon and steelhead would be expected to provide for greater production of fry and juveniles and, ultimately, greater populations of adults.

These comparisons were based on minimum flow releases prescribed by each alternative and did not consider contribution of natural runoff in the watershed to instream flow conditions. In this way, comparisons represented worst case (lowest) flows that would occur in the creek and conditions that are controllable by Hydroelectric Project facilities. During natural runoff events that are uncontrollable (canals are full and diversion dams are spilling), instream habitat conditions would be positively or negatively affected, depending on the flow rate, timing of the event, and species-life stage considered. These effects would be the same under all alternatives.

Because accuracy of the multiple layers of input data and assumed habitat relationships associated with the habitat modeling is uncertain, and unknown margins or error can be assumed exist, modeling results should be considered approximate. Therefore, the small differences

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[4]Temporary impacts include those which occur during construction, but would dissipate over time or be corrected after construction on the same site. Permanent impacts include those which occur within the footprint of permanent project features, such as fish ladders, and cannot be corrected on the same site or, otherwise, cannot be compensated due to lack of opportunity or effective methods.

produced in many cases among action alternatives for spawning and rearing habitat capacity are probably not meaningfully different. The primary conclusions from modeling spawning and rearing habitat capacity should be that all of the restoration alternatives would provide considerable benefits compared to the No Action Alternative and, otherwise, only clear differences (in consideration of potential modeling error, a difference of 20% or more would be a conservative criterion) among action alternatives should be considered meaningful. This does not imply that no other differences exist among alternatives, but that the model does not reliably quantify them. Based on the 20% difference criterion, modeling results indicated a spawning capacity advantage (about 32% increased area) for steelhead under the Proposed Action and Six-Dam Removal Alternative (BCWG flow prescription), primarily in the South Fork, compared to the No-Dam Removal and Three-Dam Removal alternatives (AFRP flow prescription).

Flow-habitat relationships were not modeled for the Soap, Ripley, or Baldwin creek tributaries to Battle Creek, as IFIM data were not available. However, under the Proposed Action and Six-Dam Removal Alternative, flow releases in Soap, lower Ripley, and Baldwin creeks would substantially increase spawning and rearing habitat capacities (especially for steelhead and resident rainbow trout) in those creeks by providing at least 5-cfs releases in Baldwin Creek and all natural flows (dams removed) in Soap and lower Ripley creeks. Under the No Action and No-Dam Removal alternatives, no flow releases would be required on any of these tributaries. Under the Three-Dam Removal Alternative, Baldwin Creek would get a 10-cfs flow below Asbury Dam, but no flows releases would be required on Soap or Ripley Creeks.

Fry and Juvenile Production. Production of fry and juveniles relative to differences in temperature among Restoration Project alternatives was modeled for winter-, spring-, and late fall-run Chinook salmon and steelhead (USBR and SWRCB 2003). In general, water temperature differences among the alternatives depend on differences in Hydroelectric Project infrastructure and operations; such as minimum instream flows; where, when, and how much water is diverted; releases of cold spring water; presence or absence of powerhouse tailraces and their configurations; and degree of mixing of water from the North and South forks of Battle Creek. Cooler water temperatures are generally assumed to provide for greater fry and juvenile numbers and, ultimately, greater populations of adults. Results generally indicated substantially improved fry and juvenile production for all salmon runs and steelhead under all action alternatives, compared to the No Action Alternative (temperature effects were not modeled for fall-run Chinook salmon because current management objectives at the Coleman National Fish Hatchery include blocking fall-run at the hatchery's barrier weir) (USBR and SWRCB 2003).

As discussed above for spawning and rearing habitat capacities, modeling results for effects of temperature should be considered approximate, and perhaps only differences of 20% or more among action alternatives should be considered meaningful. Again, this does not imply that no other differences exist among alternatives, but that the model does not reliably quantify them. Based on this rationale, the primary conclusions from modeling fry and juvenile production should be that all of the restoration alternatives would provide considerable temperature benefits compared to the No Action Alternative and, otherwise, modeling results indicated two other clear differences in temperature benefits: a fry production advantage (about 35% more fry) for steelhead under the Proposed Action and Six-Dam Removal Alternative, primarily in the South Fork, compared to the No-Dam Removal and Three-Dam Removal alternatives; and a juvenile production advantage (about 36% more juveniles) for steelhead under the No-Dam Removal and Three-Dam Removal alternatives, primarily in the South Fork, compared to the Proposed Action and Six-Dam Removal Alternative.

In two other instances, differences among alternatives for fry and juvenile production approached 20%: a spring-run fry production benefit (about 17% more fry) was predicted under the No-Dam Removal Alternative (primarily on the South Fork) compared to the Proposed Action and Six-Dam Removal Alternative; and a winter-run juvenile production benefit (about 17% more juveniles) was predicted under the No-Dam Removal Alternative (primarily due to exceptionally large numbers predicted on the Coleman reach) compared to the Proposed Action and Six-Dam Removal Alternatives. However, the temperature model does not account for inflows to the South Fork from Soap and lower Ripley creeks, which are fed by cold water springs, and should provide temperature benefits under the Proposed Action and Six-Dam Removal Alternative. Flows from Soap and lower Ripley creeks are not released under the No-Dam Removal and Three-Dam Removal alternatives. Moreover, the mechanism contributing cool water benefits to the South Fork under the No-Dam Removal Alternative–inflow of colder North Fork water at the South and Inskip powerhouse tailraces–also produces adverse effects for migrating adult salmon and steelhead due to mixing of North Fork and South Fork water (i.e., false attraction).

<u>Cold Water Refugia.</u> BCWG-derived flow prescriptions incorporated into the Proposed Action and Six-Dam Removal Alternative include the release of cold spring water into Battle Creek at Eagle Canyon on the North Fork, and Soap Creek and lower Ripley Creek tributaries to the South Fork. Instream flows provided below Asbury Dam on Baldwin Creek (a tributary to the mainstem Battle Creek) would contain spring water from Darrah Springs. Release of cold spring water into the natural stream channels provides cool water habitat refugia for winter- and spring-run Chinook salmon holding in the creek during spring and summer. The tributaries also should provide some spawning habitat, primarily for steelhead, but also for Chinook salmon (USBR and SWRCB 2003). Spring water releases to Battle Creek would be especially beneficial for winter-run Chinook salmon, as they originally were obligated to streams largely derived from cold-water springs (USFWS 1963). A restored winter-run population in Battle Creek would help spread the risk of population declines in the Sacramento River basin, as the only other population of winter-run occurs in the main stem Sacramento River below Shasta Dam, where the risk of total reproductive failure due to lethal water temperatures is at least 2 years out of 100, and risk of partial reproductive failure is 1 year out of 10 (USBR 1991).

Spring water releases would also occur at Eagle Canyon and Baldwin Creek under the Three-Dam Removal Alternative, but benefits would be less than the Proposed Action and Six-Dam Removal Alternative, as Soap and lower Ripley creeks would not have instream flow releases. The No-Dam Removal Alternative would not provide any spring water releases or associated benefits.

<u>Fish Passage–False Attraction.</u> False attraction to South Fork Battle Creek due to the cross-basin transfer of North Fork water to the South and Inskip powerhouses and subsequent discharge into the South Fork channel would be addressed under the Proposed Action and Six- and Three-Dam Removal alternatives. Under the Proposed Action and Six-Dam Removal Alternative, a tailrace connector tunnel at the South Powerhouse and tailrace connector at the Inskip Powerhouse would

direct powerhouse discharge into Inskip and Coleman canals, respectively, and largely keep mixed North Fork and South Fork water from entering the South Fork channel. Construction of the penstock bypass pipeline/chute at the Inskip Powerhouse would largely keep mixed North Fork and South Fork water from entering the South Fork channel during powerhouse outages. This would help prevent confounding of olfactory cues and water temperature gradients, which help guide migrating adults to their natal habitat for spawning.

Migrating winter- and spring-run Chinook salmon returning to North Fork Battle Creek would more likely be attracted into the South Fork after sensing North Fork water mixed with South Fork water. Maintaining the fidelity of fish natal to the North Fork should help ensure survival of winter- and spring run Chinook salmon populations during adverse stream conditions elsewhere in the Sacramento River basin (USBR and SWRCB 2003). Guarding against false attraction might prevent the South Fork from becoming a drain on winter- and spring-run Chinook salmon populations produced in the North Fork, and the important North Fork drought refugia from being under-seeded during a drought.

In addition, adult fish migrating upstream in the South Fork would less likely key on localized zones of cooler water below powerhouse tailraces, arrest upstream movement too early, and spawn in these zones where planned or unplanned powerhouse outages, or other disruptions of normal powerhouse discharges above these zones, could result in stream temperatures above the maximum threshold for salmonid eggs or fry. This potential miscue is important because the natural cool water habitat needed to restore spring-run Chinook salmon and steelhead are located at distant upstream reaches of the South Fork (USBR and SWRCB 2003). Uninterrupted migration to the natural upstream spawning habitat facilitated by normal temperature gradients could benefit the recovery of naturally producing spring-run Chinook salmon and steelhead populations in South Fork Battle Creek.

Under the Three-Dam Removal Alternative, benefits to anadromous fish migration from reduced mixing of North Fork and South Fork water would be the same as under the Proposed Action and Six-Dam Removal Alternative for Inskip powerhouse discharge, as the same tailrace connector would be constructed to the Coleman Canal. However, because the penstock bypass at Inskip powerhouse would not be constructed under the Three-Dam Removal Alternative, greater potential for spill of North Fork water from the Inskip Canal through natural pathways into the South Fork would exist, particularly during unplanned outages of the Inskip Powerhouse. In addition, the Three-Dam Removal Alternative would construct a tailrace separator channel instead of a tailrace connector tunnel the South Powerhouse. Because the separator channel would be designed to function during normal flows, spillage of mixed North Fork and South Fork water could occur during abnormally high flows. The No-Dam Removal Alternative would not provide any benefits with regard to false attraction.

Fish Passage–Natural Barriers. A key consideration used by the BCWG for establishing minimum instream flow prescriptions was facilitation of upstream passage of adult anadromous fish beyond natural barriers to preferred holding and spawning habitat (Kier Associates 1999). Any of the action alternatives should provide improved passage past natural barriers by adult salmon and steelhead, and would be expected to increase survival and spawning success, leading to higher production and population numbers, compared to the No Action Alternative. Results of a comparison among the Restoration Project alternatives (USBR and SWRCB 2003:Table 4.1-8a to 8c) indicated that the Proposed Action and Six-Dam Removal Alternative (BCWG minimum flow prescription) would always provide better passage over natural barriers than the No-Dam Removal and Three-Dam Removal alternatives (AFRP Minimum flow prescription). In the absence of temporary higher flows during storms, passage over natural barriers would be permitted at more locations, for more anadromous fish species-runs, and during more months under the Proposed Action and Six-Dam Removal Alternatives.

Fish Passage–Upstream Migration at Diversion Dams. The Restoration Project addressed upstream fish passage at Hydroelectric Project diversion dams with new failsafe fish ladders. In cases where diversion dams would no longer be needed by the Hydroelectric Project because of reduced diversions to increase instream flows, removal of dams would provide enhanced fish passage. Any of the action alternatives should provide much improved upstream passage past diversion dams compared to the No Action Alternative as a result of diversion dam removal and/or construction of new failsafe fish ladders. Improved adult fish passage would be expected to permit better utilization of available spawning habitat, increased spawning success, and ultimately, higher population levels of anadromous salmonids.

The conservative design approach to fish ladder design, coupled with the relatively low height of dams, would be expected to provide high adult passage reliability. The effective flow range of new fish ladders would be at least ten times that of existing ladders and, therefore, should provide much more efficient passage in terms of reduced delay, energy expenditure, and injury. Although only a relatively small area of stream is affected, fish ladders create a passage bottleneck and concentrate migrating fish into small areas; therefore, efficiency of new fish ladders also might substantially reduce predation on migrating individuals compared to the No Action Alternative. Although fish ladders were conservatively designed to be state-of-the-art and failsafe, fish ladder design is an art, and each ladder design is unique and untested. Some additional level of delay, energy expenditure, and potential for injury or predation would still exist compared to dam removal. Therefore, removal of dams should be considered more reliable for fish passage, as the obstacle would be removed altogether, eliminating any concern regarding ladder effectiveness.

Under the Proposed Action, removal of Wildcat, South, Soap Creek Feeder, Lower Ripley Creek Feeder, and Coleman diversion dams coupled with construction of new fish ladders at remaining diversion dams should permit significantly improved upstream passage of adults to preferred spawning habitat compared to the No Action Alternative. Like all alternatives incorporating fish ladders, deficiencies in effectiveness of any fish ladder design might be correctable through adaptive management; however, only the Proposed Action presently provides funding for adaptive management. Additional differences among the action alternatives probably would be related only to any relative passage efficiencies of removing or retaining diversion dams. In this respect the Six-Dam Removal Alternative would be the most efficient for adult passage, followed by the Five-Dam Removal Alternative, Three-Dam Removal Alternative, and No-Dam Removal Alternative.

Fish Passage–Downstream Migration at Diversion Intakes. The Restoration Project addressed downstream fish passage at Hydroelectric Project diversion intakes with new failsafe fish screens. In cases where diversions would no longer be needed by the Hydroelectric Project because of reduced diversions to increase instream flows, removal of diversion dams would eliminate diversion intakes. Any of the action alternatives should provide much improved downstream passage past diversion intakes compared to the No Action Alternative as a result of diversion removal and/or construction of new failsafe fish screens. Improved juvenile fish passage would be expected to permit better utilization of available rearing habitat, increased survival of juvenile fish, and ultimately, higher population levels of anadromous salmonids.

The conservative design approach to fish screen design and conformance to fish screen design criteria established by NOAA Fisheries (NMFS 1997a) and CDFG (CDFG 1997) would be expected to minimize entrainment and impingement of juveniles at diversions, and increase reliability of safe passage. Failsafe screens designed to automatically shut off the diversion whenever the fish screen fails to meet design or performance criteria should further increase reliability of safe passage. Where dams and diversions are retained, construction of tailrace connectors would reduce the volume of diverted water at intakes, thereby reducing the potential for entrainment and impingement, while maintaining the same volume of flow within the Hydroelectric Project conveyance system.

Under the Proposed Action, removal of Wildcat, South, Soap Creek Feeder, Lower Ripley Creek Feeder, and Coleman diversions coupled with construction of new fish screens at remaining diversions should permit significantly improved downstream passage of juveniles compared to the No Action Alternative. Like all alternatives incorporating fish screens, deficiencies in effectiveness of any fish screen design might be correctable through adaptive management; however, only the Proposed Action presently provides funding for adaptive management.

Aquatic Habitat Stability. The Hydroelectric Project's system of canals and/or powerhouses is subject to planned and unplanned outages, during which time water that cannot be conveyed through powerhouses or canals is released to the natural stream channel at any of a number of spill outlets at the dams or along the canals (USBR and SWRCB 2003). Fluctuations in transitory wetted habitat that is created during spills, then de-watered as conveyance returns to normal, can adversely affect anadromous fish and other aquatic organisms (effects on macroinvertebrates and other aquatic organisms are discussed below under *Upland and Wetland Resources*). For example, redds established in transitory habitat during wetted periods would become de-watered when instream flows recede, and juvenile and adult fish that occupy this habitat during wetted periods could become stranded if they are not able to follow receding water back to the normally wetted habitat area.

The reduced occurrence and rapidity of instream flow fluctuations that would occur under the Proposed Action compared to the No Action Alternative, would be expected to benefit anadromous fish and other fish species. The proposed tailrace connector tunnel at South Powerhouse and penstock bypass and tailrace connector at Inskip powerhouse are designed to reduce the potential for spills from the Hydroelectric Project conveyance system into Battle Creek during planned and unplanned facility outages. Rather than spill into the South Fork during a powerhouse outage, the tailrace connector tunnel, penstock bypass, and tailrace connector would route water back into the canal system beyond the powerhouses reducing potential for flow fluctuations in reaches below spill outlets. Removal of South, Coleman, and

Wildcat diversion dams, where hydroelectric values would be marginal after minimum instream flows are met, should further reduce instream flow fluctuations resulting from planned or unplanned outages of diversions or canals associated with the dams (particularly South and Wildcat).

Under the Six-Dam Removal Alternative, benefits of the penstock bypass and tailrace connectors are the same as under the Proposed Action. The Six-Dam Removal Alternative also would provide the same benefits as the Proposed Action for reduced instream flow fluctuations due to fewer canal outages, but with an added incremental benefit from removing Eagle Canyon Dam. The Three-Dam Removal Alternative would provide similar tailrace benefits as the Proposed Action, except that the tailrace separator channel used in place of a tailrace connector tunnel at the South Powerhouse would be prone to mixing into the South Fork during higher than normal creek flows. This alternative also would provide benefits of fewer canal outages with respect to Wildcat, Eagle Canyon, and Coleman diversion dam removal, but would not provide reduced canal outage benefits from removal of Soap and Lower Ripley diversion dams. The No-Dam removal Alternative would not provide any benefits from tailrace connectors or dam removal.

Ramping rates prescribed by the Restoration Project for altering instream flows during Hydropower Project operations (0.1 ft/hr) would further benefit anadromous fish and other fish species. Under the No Action Alternative (present FERC license), there is no requirement for rate of flow changes below the dams. Juvenile and adult fish occupying transient habitat during Hydroelectric Project outages might more easily follow receding waters back to the normally wetted stream channel following the outages if the waters recede more slowly (Kier Associates 1999). All action alternatives include the same prescribed ramping rates.

<u>SRA Cover.</u> Another potential ecosystem-level benefit of the Restoration Project for fish and aquatic resources is enhancement of SRA cover along the edges of Battle Creek . The amount of SRA cover present on Battle Creek is unknown, as it has not been inventoried. But because of the relatively small width of Battle Creek compared to the size of adjacent riparian vegetation, a high proportion of Battle Creek could probably be considered SRA cover. Riparian vegetation that either overhangs or protrudes into the water; instream woody debris, such as leaves, logs, branches and roots; and often substantial amounts of detritus provide high quality food and cover for fish and other aquatic species (USFWS 1992). Improved flow regimes that are proposed under all action alternatives could enhance riparian vegetation, as described below under Upland and Wetland Resources, and help enhance the extent and perpetuation of associated SRA cover.

Relative enhancement of riparian habitat or SRA cover has not been evaluated among alternatives for the Restoration Project, but because riparian vegetation is especially sensitive to changes in minimum and maximum instream flows (Auble et al. 1994, cited in The Instream Flow Council 2002), it might be assumed that the higher minimum flows of the Proposed Action and Six-Dam removal alternatives, particularly during the drier summer months, would provide greater SRA cover benefits than the No-Dam Removal and Three-Dam Removal Alternatives in reaches of Battle Creek where AFRP and BCWG minimum flow regimes are most different.

<u>Adaptive Management.</u> Because determining the effectiveness of Restoration Project actions would require monitoring population levels and habitat use, and unanticipated factors could

affect fishery restoration results, the Restoration Project would implement adaptive management as a tool to monitor initial results and refine actions being taken. The use of adaptive management should increase the probability that the Restoration Project would achieve its objectives. For example, effects of minimum flow prescriptions could be evaluated, and effectiveness of fish screens and ladders could be monitored and structures modified, as necessary, to achieve desired performance. Monitoring also would provide information on population changes over time to help ascertain success of restoration actions.

The Restoration Project has incorporated adaptive management into all alternatives, and a draft AMP has been developed exclusively for the Proposed Action. At present, the Proposed Action has the unique advantage of having acquired funding for implementing the AMP and acquiring additional flows, as needed.

Adverse Effects
All action alternatives are designed to benefit the stream ecosystem, including fisheries and aquatic resources. Appropriate mitigation measures incorporated into the actions would largely avoid incidental adverse effects. However, all of the action alternatives have potential for temporary, incidental adverse effects on fisheries and aquatic resources, such as increased mortality or reduced reproductive success.

Temporary adverse effects may result from actions involving instream work, including streambank modification, fish screen and ladder installation, and tailrace modifications. Fish in all life stages and other aquatic organisms would be subject to impacts of instream construction activities, including cofferdam construction, form building and concrete pouring, stream channel alteration, heavy equipment movements in the streambed, de-watering and re-watering of work sites, blasting, and placement of dismantled dam debris into the stream channel have potential for impacts. Soils and sediment trapped behind dams would be disturbed and temporarily degrade water quality through turbidity and sedimentation, including potential siltation of salmonid spawning habitat downstream.

Construction of new roads and other earth moving activity adjacent to the creek also can induce sedimentation. Changes in stream hydrology due to removal or modification of diversion dams and tailraces also may adversely alter sediment transport and deposition. Eggs of fish and other aquatic organisms may be adversely affected by shockwaves from blasting within, or outside of, the stream channel. Instream habitat structure, such as pools, riffles, and spawning gravel also may be disturbed or altered in construction areas or from changes in stream hydrology caused by removal or modification of water control structures. Risks also exist for oil and grease discharges into the creek from heavy equipment within the streambed.

Impacts to riparian habitats could also affect fish species. In particular, SRA cover, which provides valuable cover for fish and shade that can moderate water temperatures, would be lost (the amount has not been estimated). Also, wetland habitat associated with the stream channel, which can provide similar wildlife benefits as SRA cover, also would be lost by a small amount. However, improved flow regimes that are proposed under all action alternatives should help restore lost riparian and wetland habitat, and enhance riparian and wetland habitat that remains.

The Restoration Project Draft EIS/EIR (USBR and SWRCB 2003) provides a summary of adverse impacts to fisheries and aquatic resources that could result from implementing each of the four Restoration Project alternatives at specific sites, and identifies mitigative measures that would be implemented. Further discussion of mitigative measures is provided below under *Mitigation*.

Upland and Wetland Resources

The following assessment assumes baseline conditions would be equivalent to those under the existing FERC license (i.e., without the interim agreement), which represents the NEPA baseline (future without the project). Although the Restoration Project is designed to primarily benefit anadromous fish and instream habitat, the ecosystem approach taken to develop restoration actions should produce benefits for riparian vegetation and non-piscine animal species associated with the stream and riparian corridor. These expected benefits would be derived primarily from higher instream flows, reduced unnatural fluctuations in instream flow, reduced entrainment of nutrients into Hydroelectric Project canals, and conversion of decommissioned Hydroelectric Project tunnels into new or enhanced bat habitat. Because less instream flow would be diverted under all action alternatives, the proposed flow regime would more closely resemble that of Battle Creek's natural, unimpaired hydrograph and should be better suited for the Battle Creek ecosystem than that under the No Action Alternative (see Gore and Mead 2001). However, incidental temporary and permanent impacts to upland and wetland resources also would occur during Restoration Project construction due to disturbance and removal of habitat.

Environmental Benefits

<u>Wetted Habitat Area.</u> The prescribed minimum instream flow releases under the Proposed Action (BCWG flows) are 12 to 29 times greater in the North Fork and 8 to 17 times greater in the South Fork, depending on reach and time of year, compared to the No Action Alternative (FERC license conditions). Increased minimum flows would significantly increase the amount of wetted habitat area available for fish in the mainstem, North Fork, and South Fork Battle Creek (USBR and SWRCB 2003: Table 4.1-10) and should benefit species using aquatic habitat for foraging, cover, or reproduction (e.g., northwestern pond turtle, foothill yellow-legged frog, and salamanders). Although not quantified, the affected areas of Soap, lower Ripley, and Baldwin creeks also would substantially increase. Greater wetted habitat area would be expected to provide greater production of periphyton and aquatic macroinvertebrates, which form the basis of the food chain in stream ecosystems, and provide a primary food source for other species, such as turtles, frogs, and salamanders. Aquatic insects that metamorphose into aerial and terrestrial insects would contribute to the food supply of insectivorous wildlife, such as birds and bats that forage in riparian and adjacent habitats. Farther up the food chain, wildlife species that prey on amphibians and fish, such as green herons, common mergansers, bald eagles, osprey, racoons, and river otters also would benefit from increased wetted habitat area.

The Six-Dam Removal Alternative (BCWG flows) would provide somewhat higher flows and wetted habitat area downstream of the Eagle Canyon and Wildcat diversion dam sites and mainstem compared to the Proposed Action, due to removal of Eagle Canyon Dam (USBR and SWRCB 2003: Table 4.1-10). The Three-Dam Removal Alternative (AFRP flows) would have less wetted area compared to the Proposed Action and Six-Dam Removal Alternatives due to smaller flow releases at remaining diversion dams. The No-Dam Removal Alternative (AFRP flows) would generally have less wetted area than the Proposed Action and Six Dam Removal Alternative, except below Eagle Canyon and Wildcat diversion dams where it is higher during wet months (December through April).

Wetted Habitat Temperature. Another potential benefit from increased flows under the Proposed Action is cooler water temperatures in summer, which should be more similar to seasonal temperatures in which species, such as amphibians and macroinvertebrates, evolved. Like fish, amphibians and macroinvertebrates can be adversely affected if water temperatures exceed their biological tolerances, and more-natural temperature regimes are more likely to provide optimal temperatures for these species' life cycles. All other action alternatives should also provide water temperature benefits to these species; however, it would be difficult to estimate relative temperature benefits among the alternatives, because temperature relationships for these species are not necessarily the same as for fish, and data for non-piscine species are not available for Battle Creek.

Wetted Habitat Stability. The reduced occurrence and rapidity of instream flow fluctuations that would occur under the Proposed Action compared to the No Action Alternative would be expected to further benefit non-piscine species of the stream and riparian corridor. Diverted water that normally would be contained within the Hydroelectric Project system, would be temporarily spilled or released into stream channels during canal or powerhouse outages. Resulting fluctuations of instream flow can adversely affect amphibians and macroinvertebrates through changes in water temperature and wetted habitat area. Spilled water from canals can become warmed as it runs overland and, upon draining into the creek, can increase creek temperatures to harmful levels. Alternating from spilling to normal conveyance can result in temperature fluctuations in natural stream channels (USBR and SWRCB 2003), and such fluctuations can adversely affect macroinvertebrates (Gore and Mead 2001). Fluctuations in transitory wetted habitat that is created during spills, then de-watered as conveyance returns to normal, can adversely affect immobile biota that occupy this habitat during the wetted periods (e.g., sessile macroinvertebrates or eggs of macroinvertebrates and amphibians).

The proposed South Powerhouse bypass tunnel and tailrace connectors at the South and Inskip powerhouses are designed to reduce the potential for spills from the Hydroelectric Project conveyance system into Battle Creek during planned and unplanned facility outages. Rather than spill into the South Fork during a powerhouse outage, the bypass tunnel and/or tailrace connectors would route water back into the canal system beyond the powerhouses eliminating cold water inflow and flow fluctuations in reaches below the spills. Removal of South, Coleman, and Wildcat diversion dams, due to marginal hydroelectric values, should further reduce instream flow fluctuations resulting from planned or unplanned outages of diversions or canals associated with the dams (particularly South and Wildcat).

Under the Six-Dam Removal Alternative, benefits of tailrace connectors are the same as under the Proposed Action. The Six-Dam Removal Alternative would provide the same benefits as Proposed Action for reduced instream flow fluctuations due to fewer canal outages, but with the added incremental benefit from removing Eagle Canyon Dam. The Three-Dam Removal Alternative would provide similar tailrace connector benefits as the Proposed Action, except that the tailrace separator channel at the South Powerhouse would be prone to spilling into the South

Fork during higher than normal flows. This alternative also would provide benefits of fewer canal outages with respect to Wildcat, Eagle Canyon, and Coleman diversion dam removal, but would not provide reduced canal outage benefits from removal of Soap and Lower Ripley diversion dams. The No-Dam removal Alternative would not provide any benefits from tailrace connectors or dam removal.

Ramping rates prescribed by the Restoration Project for altering instream flows during Hydropower Project operations (0.1 ft/hr) would further benefit non-piscine species. Under the No Action Alternative (present FERC license), there is no requirement for rate of flow changes below the dams. Rapid reduction of instream flows following a Hydroelectric Project outage could strand or isolate juvenile fish in the stream channel (Kier Associates 1999) and, by extension, could also strand or isolate early lifestage amphibians that might have colonized transitory habitat during temporary periods of higher flows (USBR and SWRCB 2003). Ramping down instream flows more slowly when returning hydropower facilities to service following outages should help early amphibian life stages follow declining water elevations back to the normally wetted channel and, thereby, benefit amphibian populations downstream of dams, as well as populations of species that prey on amphibians and fish (e.g., green herons, common mergansers, bald eagles, osprey, racoons, and river otters). All action alternatives include the same prescribed ramping rates.

Riparian Vegetation. Riparian ecosystems are maintained by groundwater and flood pulses (Ewing 1978, cited in The Instream Flow Council 2002). Therefore, improved flow regimes proposed under all action alternatives could help enhance riparian vegetation, in general, and SRA cover aquatic habitat, in particular, through improved geomorphological and ecological processes. Increased flows should help transport the fine sediments that riparian vegetation uses for seed germination. Also, potentially raised levels of ground water resulting from increased instream flows could enhance growth of existing riparian vegetation, and enable a wider riparian vegetation zone along Battle Creek to the benefit of wildlife species using the riparian zone.

SRA cover, as described above under *Biological Resources/Fisheries and Aquatic Resources*, is also important for amphibians and terrestrial wildlife that use riparian and stream edge habitat. This near shore aquatic area occurring at the stream-riparian habitat interface provides valuable resources, such as high quality food and cover (USFWS 1992). The amount of SRA cover present on Battle Creek is unknown, as it has not been inventoried. But because of the relatively small width of Battle Creek compared to the size of adjacent riparian vegetation, a high proportion of Battle Creek could probably be considered SRA cover. Relative enhancement of riparian habitat or SRA cover has not been evaluated among alternatives for the Restoration Project, but because riparian vegetation is especially sensitive to changes in minimum and maximum instream flows (Auble et al. 1994, cited in The Instream Flow Council 2002), it might be assumed that the higher minimum flows of the Proposed Action and Six-Dam removal alternatives, particularly during the drier summer months, would provide greater riparian habitat benefits than the No-Dam Removal and Three-Dam Removal Alternatives in reaches of Battle Creek where AFRP and BCWG flow regimes are most different.

Enhanced Bat Habitat.

Many bats have been observed on the Restoration Project area and there is potential for an estimated seven species (all are Species of Concern) to be present. Creation or enhancement of bat habitat and potential increases in abundance and diversity of bats on the Project Area would help mitigate for potential adverse effects on bats during Restoration Project construction, and provide ecosystem level benefits to the Restoration Project area. Removal of the South Diversion Dam and associated facilities under the Proposed Action or Six-Dam Removal Alternative would result in termination of Hydroelectric Project water flow through the South Canal tunnels. Rather than seal off tunnel entrances, the entrances would be fitted with bat gates specifically designed to create proper microclimates for targeted (to be determined) bat species, and substantially increase roosting, breeding, or hibernating habitat (USBR and SWRCB 2003). Under the Three-Dam Removal Alternative, decommissioning of Eagle Canyon

Adverse Effects

In Addition to environmental benefits, many components of the Restoration Project would result in incidental adverse effects on upland, riparian, and wetland habitats. Construction with heavy equipment would occur in both terrestrial and aquatic habitats on at least 10 primary sites within the project area. However, with appropriate mitigation measures it should be possible to avoid, minimize, and compensate for incidental adverse effects, to the extent possible, and keep unavoidable adverse effects to an acceptable level.

Habitats and associated wildlife species could be either temporarily or permanently affected by all action alternatives of the Restoration Project. Amounts of particular habitats that would be affected and their locations vary by project alternative (Table 6). Most of these impacts would occur from construction of fish screens and ladders, construction of access roads and staging areas, and removal of dams and associated facilities. Habitat areas falling within the footprint of permanent project features (e.g., fish screens or ladders, maintenance areas, or permanent roads) would be permanently lost. The proportions of impacts that would be temporary or permanent has not yet been determined, as project designs are not yet complete. However, is expected that most of the affected area would be permanently impacted.

Some of the most significant impacts involve riparian vegetation and wetlands. Much of the riparian habitat impact would be permanent. Impacts to riparian habitats could also affect wildlife species that use SRA cover, which provides valuable cover structure and shade that can moderate water temperatures (the amount of SRA cover that would be affected has not been estimated). Wetlands associated with the stream channel, which can provide similar wildlife benefits as SRA cover, would be lost by a small amount. However, the improved flow regime that is proposed under all action alternatives could help restore lost riparian and wetland habitat and enhance riparian and wetland habitat that remains. Impacts to blue oak woodland/savanna, although not a rare habitat in the project area, are important, as oak communities take a relatively long time to mature on compensation sites and the mitigation ratio is relatively high (5:1).

Table 6. Estimated upland and wetland habitat losses (acres) resulting from alternatives of the Battle Creek Salmon and Steelhead Restoration Project (USBR and SWRCB 2003). Data are not yet available to distinguish temporary impacts from permanent.

Habitat Type	Resource Category	Five-Dam Removal (Proposed Action)	No-Dam Removal	Six-Dam Removal	Three-Dam Removal
Annual grassland	3	11.2	10.9	11.2	11.1
Mixed chaparral	3	3.4	2.1	3.4	3.4
Westside ponderosa pine	3	0	0	0	0
Live oak woodland	2	25.9	14.6	25.9	14.6
Blue oak woodland/savanna	2	49.6	22.3	49.6	24.8
Gray pine/oak woodland	2	3.4	1.7	3.4	3.4
Emergent wetland	2	0.1	0.1	0.1	0.1
Seasonal wetland	2	0.6	0.6	0.6	0.6
Emergent scrub wetland	2	0	0	0	0
Groundwater seep	2	0.5	0.5	0.5	0.5
Riparian forest/riparian scrub	2	6.0	4.1	7.2	6.0

The Restoration Project Draft EIS/EIR (USBR and SWRCB 2003) provides a summary of adverse impacts to botanical, wetland, and wildlife resources that could result from implementing each of the four Restoration Project alternatives at specific sites, and identifies mitigative measures that would be implemented. Further discussion of mitigative measures is provided below under *Mitigation*.

Special Status Species

Environmental Benefits

Because the purpose of the Restoration Project is to enhance and restore anadromous fish habitat, long-term effects on aquatic habitat and fisheries due to the Restoration Project would largely be beneficial. Benefits to winter-, spring-, and late fall-run Chinook salmon and steelhead are described above under *Fisheries and Aquatic Resources*.

Although the Restoration Project is designed to primarily benefit anadromous fish and instream habitat, the ecosystem approach taken to develop restoration actions also should be expected to produce benefits for terrestrial and wetland/riparian special status species. Benefits to habitats used by terrestrial and wetland/riparian special status species are described above under *Upland and Wetland Resources*. Federally listed species that might benefit from the Restoration Project include bald eagle (due to enhanced fisheries) and valley elderberry longhorn beetle (due to enhanced riparian vegetation). Other special status species that might benefit from enhanced fisheries and/or riparian habitat are foothill yellow-legged frog, northwestern pond turtle, golden eagle, osprey, Cooper's hawk, sharp-shinned hawk, American peregrine falcon, Vaux's swift, little willow flycatcher, yellow-breasted chat.

Adverse Effects

Some project construction activities could result in incidental adverse effects to listed species under the jurisdiction of the Service (valley elderberry longhorn beetle) and NOAA Fisheries (spring- and winter-run Chinook salmon and steelhead). Potential effects to spring- and winter-run Chinook salmon and steelhead are described above under *Fisheries and Aquatic Resources*. These effects should be temporary and minimal due to conservation measures that are identified in the Restoration Project's Draft EIS/EIR (USBR and SWRCB 2003) and that will be included in the Action-Specific Implementation Plan (ASIP) (in preparation). Further discussion of mitigative measures is provided below under *Mitigation*.

Vegetation and wildlife surveys conducted for the Restoration Project (JSA 2001a, 2001b) suggested that potential adverse effects on federally listed species under the jurisdiction of the Service (identified above under *Biological Resources/Special Status Species*) would likely only involve the valley elderberry longhorn beetle (USBR and SWRCB 2003). About 17 elderberry shrubs having stems at least 1 inch in diameter at ground level have been found in the project area (USBR and SWRCB 2003). Most occur on roadsides and would be directly or indirectly impacted from road improvement activities. Others occur on construction sites at Eagle Canyon and Coleman diversion dams, Inskip Diversion Dam/South Powerhouse, and lower Ripley Creek Feeder. No exit holes from valley elderberry longhorn beetles have been confirmed on the Restoration Project area (USBR and SWRCB 2003), but old exit holes have been found in elderberry shrubs 0.7 mile east of Paynes Creek, approximately 5 miles away from the Restoration Project area (CDFG 2003). A few stems with possible exit holes were found in two separate large clusters of elderberry shrubs located on the South Powerhouse alternative access road, but the holes were old, and it was uncertain whether they were made by emerging valley elderberry longhorn beetles, other wood-boring insects, or woodpeckers (USBR and SWRCB 2003). Pre-construction surveys are in progress to update and more precisely define potential impacts; results will be included in the ASIP for the Restoration Project. Reclamation has committed to follow the Service's *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999) for implementing the Restoration Project, and dust control would be implemented during construction activities (USBR and SWRCB 2003).

Bald eagles are known to nest at a site near the Coleman National Fish Hatchery, but no signs of nesting were observed within, or near, the project area (JSA 2001a, 2001b). Bald eagles might forage along Battle Creek, as two individuals were observed flying over the area, but Reclamation estimates that the potential for disturbance of bald eagles by the Restoration Project probably is low due to low use of the area by bald eagles and availability of extensive alternative foraging sites (USBR and SWRCB 2003).

No habitat was found on the project area during surveys for vernal pool fairy shrimp, vernal pool tadpole shrimp, or slender Orcutt grass. No habitat was found for red-legged frog using Service protocols (USFWS 1997). Sacramento splittail and delta smelt occur downstream of the project area in the Sacramento River watershed, but quantity and quality of Battle Creek water entering the Sacramento River is not expected to change as a result of the Restoration Project.

Other special status species that are not federally listed also could be adversely affected by the Restoration Project. Those known to occur on the project area are the foothill yellow-legged frog; northwestern pond turtle; seven bird species, including three raptors; potentially eight bat species; and four species of plants (species are identified above under *Biological Resources/ Special Status Species*). These effects should be temporary and minimal due to conservation measures that are identified in the Restoration Project's Draft EIS/EIR (USBR and SWRCB 2003) and that will be included in the Action-Specific Implementation Plan (ASIP) (in preparation), which also will include a mitigation plan for sensitive natural communities pursuant to the State's Natural Communities Conservation Planning Act. Further discussion of mitigative measures is provided below.

MITIGATION

Restoration Project Commitments

The Restoration Project's Draft EIS/EIR (USBR and SWRCB 2003) provides a set of mitigation strategies based on the *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (CEQ 1978). Because the Service's Mitigation Policy also adopts the CEQ's mitigation definition, the Restoration Project's basic mitigation strategies are consistent with the Service's Mitigation Policy. The Restoration Project's Draft EIS/EIR also contains a set of general environmental protection measures that would be implemented before and during construction, that are consistent with the CALFED ROD (CALFED 2000b). To a large extent, the environmental protection measures were developed through coordination with the Service and other resource agencies for purposes of the Restoration Project. These environmental protection measures are generally consistent with mitigation measures typically recommended by the Service, and will not be repeated here. However, additional measures that are specific to components of the Restoration Project, or to specific wildlife species are provided by the Service (see below). With implementation of protective and mitigative measures to avoid and minimize adverse effects to the extent possible, remaining unavoidable adverse effects would mostly be minor and short term, and all would be mitigable.

Environmental protection measures for fisheries and water quality impacts emphasize initial avoidance and minimization of impacts to the extent possible. Most direct impacts to salmon and steelhead would be avoided by confining them to the areas below Coleman and Eagle Canyon Diversion Dams during project construction, conducting instream work during low flow periods, and using best management practices (USBR and SWRCB 2003). Environmental protection measures for vegetation and wildlife also begin with avoidance and minimization of impacts to the extent possible (USBR and SWRCB 2003). This would reduce loses of existing biological values in the project area, as well as reduce planning, land acquisition, and funding needed for mitigation.

Compensating for unavoidable habitat losses would be consistent with CALFED directives, and would ensure that fisheries and aquatic habitat benefits from the Restoration Project would not be offset by incidental adverse impacts of project construction. In this way, the Restoration Project's contribution to overall ecosystem quality in the Restoration Project area could be maximized.

Specific mitigation considerations and enhancement opportunities

Mitigation Plan

An important aspect of the Restoration Project will be the development and implementation of the *Post Construction Mitigation/compensation/restoration and Reporting Plan*, as referenced in the Draft EIS/EIR. In the Service's view, mitigation should equal or exceed the quality of the habitat to be adversely affected by the project. Judging the ultimate success of the project should include success of mitigation. Mitigation success criteria should be developed toward equaling or exceeding the quality of the highest quality habitat to be affected. Criteria should be developed for assessing the progress of mitigative measures during their developmental stages as well. Assessment criteria should include criteria such as rates of plant growth, plant health, and evidence of natural reproduction. The plan should include a comparison of the soils and aspects of the proposed mitigation sites with those of impacted sites, and a determination made as to the suitability of the mitigation sites to support habitats consistent with the mitigation goals. A mitigation plan must include a timeframe for implementing the mitigation in relation to the proposed project. If there will be a substantial time lag between project construction and completion of the mitigation, a net loss of habitat values would result.

The plan should define how the site would be maintained during the mitigation establishment period, and how long the establishment would take. It would also be important to note what entity will perform the maintenance activities, and what entity will ultimately own and manage the site. In addition, a mechanism to fund the maintenance and management of the site should be established and identified. A permanent easement should be placed on the property used for the mitigation that would preclude incompatible activities on the site in perpetuity.

In general, monitoring of the mitigation site should occur annually for at least the first five years, biennially for years 6 through 11, and every five years thereafter until the mitigation has met all success criteria. Remedial efforts and additional monitoring should occur if success criteria are not met during the first five years. Some projects will require monitoring throughout the life of the project. Reports should be prepared after each monitoring session.

Because of their very high value to migratory birds, and ever-increasing scarcity in California, our mitigation goal for wetlands (including riparian and riverine wetlands) is no net loss of in-kind habitat value or acreage, whichever is greater. As a result of their high value and reliance on suitable hydrological conditions, wetlands require development of additional information on the predicted hydrology of the mitigation site. The plan should describe the depth of the water table, and the frequency, duration, areal extent, and depth of flooding which would occur on the site. The hydrologic information should include an analysis of extreme conditions (drought, flooding) as well as typical conditions.

Compensation for Lost Habitat

It should be possible to avoid impacts to most upland habitats falling outside of permanent project features. However, it is recognized that some incidental impacts would be unavoidable.

Post-project assessments would need to assess these impacts in greater detail than presently estimated in the Draft EIS/EIR. The assessments should include impacts by project construction site, quantity and quality of affected habitats, temporary vs. permanent impacts, and needs for mitigation. Pursuant to the Service's Mitigation Policy, the Service recommends the compensation ratios in Table 7 for temporary and permanent losses to upland, riparian, and wetland habitats.

Specific Mitigation Measures
Several general mitigation measures recommended by the Service have already been incorporated into the Restoration Project EIS/EIR. Other mitigation measures that are site specific or dependent on real-time conditions, such as presence/absence of certain sensitive species, must be considered on a case-by-case basis. The Service provided Reclamation with recommended mitigation measures for migratory birds and bats, with input from CDFG, in informal memorandums (dated August 30, 2001, and August 27, 2001, respectively) for purposes of early project planning. Under the Migratory Bird Treaty Act, migratory birds are protected from pursuing, hunting, taking, capturing, or killing. Nests and their contents are also protected. As a species group, birds are useful wildlife representatives for assessing and mitigating adverse impacts, as they occur within all terrestrial and wetland habitats on the project area. By addressing potential impacts to birds, many other wildlife species also can be protected. The mitigation measures for migratory birds and bats emphasize the reproductive season (a particularly sensitive period for wildlife), but also cover winter periods for bats. Consideration of these mitigation measures for migratory bird and bats should also provide for most other wildlife species potentially present. The Service continues to advocate these mitigation measures for all action alternatives of the Restoration Project (Attachments B and C). These mitigation measures are not site-specific and are intended for any action alternative. Implementing the measures might require further assessment of construction sites and activities to gain their full utility.

The Service also recommends that site-specific mitigation measures be taken for particular components of the Restoration Project. Because some details of project designs are not yet completed, it is not possible to recommend all measures that may be needed at this time. Present site-specific mitigation measures recommended by the Service are provided in Attachment D. Additional site-specific measures may be recommended in the future, as design and impact information become available.

Opportunities for Habitat Mitigation/Enhancement
Several opportunities exist to create or enhance wildlife habitat on the Restoration Project area in addition to the fisheries restoration benefits. These include creation and enhancement of bat habitat, preservation and modification of wetlands, and enhancement of wildlife movement corridors. Creation and enhancement of bat habitat is described above under *Future Conditions with the Project/Upland and Wetland Resources*. Opportunities for wetland creation and enhancement exist with the decommissioning of the Wildcat and South canals under the Proposed Action and Six-Dam Removal Alternative. Depending on topography and availability of hydrologically connected natural seeps or intermittent drainages, it might be possible to re-contour sections of the canals (the remainder would be filled in) to form wetlands. This could help mitigate for other project impacts to these resources. At the Inskip Powerhouse site, the

Table 7. Compensation[1] recommended by the Fish and Wildlife Service for upland and wetland habitat losses resulting from the Proposed Action of Battle Creek Salmon and Steelhead Restoration Project. Acreage figures will be determined when data becomes available.

Habitat Type	Resource Category	Compensation for Temporary Habitat Loss[2]	Compensation for Permanent Habitat Loss	Temporary Habitat Loss (acres)	Permanent Habitat Loss (acres)	Compensation Needed (acres)
Annual grassland	3	restore	1:1			
Mixed chaparral	3	restore plus 2:1	3:1			
Westside ponderosa pine	3	restore plus 3:1	4:1			
Live oak woodland	2	restore plus 4:1	5:1			
Blue oak woodland/ savanna	2	restore plus 4:1	5:1		(To Be Determined)	
Gray pine/oak woodland	2	restore plus 4:1	5:1			
Emergent wetland	2	restore	1:1			
Seasonal wetland	2	restore	1:1			
Emergent scrub wetland	2	restore	1:1			
Groundwater seep	2	restore	avoid impact[3]			
Riparian forest/riparian scrub	2	restore plus 4:1	5:1			

[1] Compensation ratios are based on mitigation needs calculated for like habitats in past projects that used the Service's Habitat Evaluation Procedures (HEP). Ratios reflect value of lost habitats, existing value of compensation sites, and difficulty and time required to achieve replacement value. Ratios given assume that lost habitat is of good to high quality, and initial habitat value on impact or compensation sites to be restored is zero. Ratios can be adjusted up or down if assumptions do not hold.

[2] Restore plus a ratio means to restore the impact site and then restore additional area elsewhere at the given ratio.

[3] It is assumed that groundwater seeps cannot be successfully created and permanent losses would be unmitigable.

proposed penstock bypass chute could be fitted with overpasses to provide for migration and other movements of wildlife through the canyon corridor. Likewise, the existing penstocks, which presently lay flat on the ground surface, could be fitted with underpasses, if suitable locations allow. These provisions for wildlife movements could help offset project impacts and enhance ecosystem processes associated with animal movements.

DISCUSSION

The Restoration Project is supported by several restoration plans and programs developed by State and Federal resource agencies for restoration of anadromous fisheries. In addition, the Restoration Project tiers from the CALFED ROD, and incorporates several ecosystem-level actions that target several ecosystem-level benefits consistent with the CALFED ERP. Most importantly, specific restoration needs and means to achieve them have been established through the Battle Creek Salmon and Steelhead Plan and the Restoration Project MOU. Therefore, a varied range of considerations would be needed to evaluate Restoration Project alternatives. It is expected that particular attention would be directed to the Restoration Project Purpose and Need, pursuant to NEPA and CEQA provisions.

Restoration Project actions focused on minimum instream flow requirements, management of those flows, upstream and downstream fish passage, restoration of stream function, and adaptive management. Expected ecological benefits pertain to increasing quality and quantity of spawning habitat, providing cold water refugia, reducing potential for false attraction during migration, facilitating passage for adults and juveniles past natural barriers and Hydroelectric Project facilities, improving habitat stability and continuity, and developing a process to help ensure Restoration Project success. The ecosystem approach to restoration also should provide significant benefits to riparian and wetland communities adjacent to the creeks.

Most potential restoration actions are similar among the Restoration Project Alternatives, but are generally modified and/or assembled into different configurations to address the project Purpose and Need, as well as a range of more specific objectives. Some potential actions are unique to particular alternatives. Assessment of the alternatives provided in the Draft EIS/EIR produced results that varied in some cases and appeared the same in others. One way to comparatively summarize the large set of results is to develop a comparison matrix and grade individual results for meeting the various objectives of the Restoration Project, which themselves can be weighted by relative importance. But due to time constraints and minimal opportunity for coordination among Restoration Project cooperators, this was not attempted. Instead, the primary benefits of each action alternative are qualitatively compared and summarized below. The following assessment is based on the Service's early interpretation of presently available data, and should be considered provisional:

Proposed Action (PA) (Five-Dam Removal Alternative)

- Large benefit from increased spawning and rearing habitat area due to increased minimum flows. More steelhead and resident rainbow trout benefit on South Fork, Soap Creek, lower Ripley Creek, and Baldwin Creek compared to ND and 3D.

- Large benefit from increased fry and juvenile production due to increased minimum flows. More steelhead fry benefit on South Fork compared to ND and 3D.

- Large benefit from increased area of cold water refugia due to release of spring water at Eagle Canyon, Soap Creek, lower Ripley Creek, and Baldwin Creek.

- Large benefit from reduced false attraction due to tailrace connector tunnel at South Powerhouse and penstock bypass and tailrace connector at Inskip powerhouse. More benefit due to better tailrace facility at South Powerhouse compared to 3D.

- Large benefit from passage at natural barriers due to increased minimum flow. More benefit due to higher minimum flow regime compared to ND and 3D.

- Large benefit from passage at diversion dams due to new fish ladders and dam removal. Possibly more benefit due to more dams removed compared to ND and 3D.

- Large benefit from passage at diversion intakes due to new fish screens and dam removal. Possibly more benefit due to more dams removed compared to ND and 3D.

- Large benefit from instream habitat stability and continuity due to tailrace connector tunnel at South Powerhouse and penstock bypass, tailrace connector at Inskip powerhouse, and dam removal. More benefit due to better tailrace facility at South Powerhouse compared to 3D.

- Large benefit from instream habitat stability and continuity due to prescribed ramping rates.

- Large benefit from ensuring availability of instream flows in the future due to dedication of water rights.

- Large benefit from funded adaptive management plan and funded water acquisition account.

- Large benefit from increased or enhanced wetted, wetland, and riparian habitat area and improved wetted habitat temperature and stability due to increased minimum flows, tailrace and penstock bypass facilities, prescribed ramping rates, and possibly dam removal.

- Large benefit from increased bat habitat availability due to decommissioning of South Canal tunnels.

No-Dam Removal Alternative (ND)

- Large benefit from increased spawning and rearing habitat area due to increased minimum flows.

- Large benefit from increased fry and juvenile production due to increased minimum flows. More steelhead juvenile benefit on South Fork compared to PA and 6D.

- No benefit from increased area of cold water refugia due to release of spring water.

- No benefit from reduced false attraction.

- Moderate benefit from passage at natural barriers due to increased minimum flow. Less benefit due to lower minimum flow regime compared to PA and 6D.

- Large benefit from passage at diversion dams due to new fish ladders. Possibly less benefit due to no dams removed compared to PA, 6D, and 3D.

- Large benefit from passage at diversion intakes due to new fish screens. Possibly less benefit due to no dams removed compared to PA, 6D, and 3D.

- No benefit from instream habitat stability and continuity due to tailrace connectors or penstock bypass.

- Large benefit from instream habitat stability and continuity due to prescribed ramping rates.

- No benefit from ensuring availability of instream flows in the future due to dedication of water rights.

- Moderate benefit from adaptive management plan. Less benefit due to lack of existing funding compared to PA. No funded water acquisition account.

- Large benefit from increased or enhanced wetted, wetland, and riparian habitat area due to increased minimum flows and prescribed ramping rates. Possibly less benefit due to lower minimum flow regime and no dam removal compared to PA, 6D, and 3D.

- No benefit from increased bat habitat availability.

Six-Dam Removal Alternative (6D)

- Large benefit from increased spawning and rearing habitat area due to increased minimum flows. More steelhead and resident rainbow trout benefit on South Fork, Soap Creek, lower Ripley Creek, and Baldwin Creek compared to ND and 3D.

- Large benefit from increased fry and juvenile production due to increased minimum flows. More steelhead fry benefit on South Fork compared to NDand 3D.

- Large benefit from increased area of cold water refugia due to release of spring water at Eagle Canyon, Soap Creek, lower Ripley Creek, and Baldwin Creek.

- Large benefit from reduced false attraction due to tailrace connector tunnel at South Powerhouse and penstock bypass and tailrace connector at Inskip powerhouse. More benefit due to better tailrace facility compared to 3D.

- Large benefit from passage at natural barriers due to increased minimum flow. More benefit due to higher minimum flow regime compared to ND and 3D.

- Large benefit from passage at diversion dams due to new fish ladders and dam removal. Possibly more benefit due to additional dam removals compared to PA, ND, and 3D.

- Large benefit from passage at diversion intakes due to new fish screens and dam removal. Possibly more benefit due to removal of more dams compared to PA, ND, and 3D.

- Large benefit from instream habitat stability and continuity due to tailrace connector tunnel at South Powerhouse and penstock bypass, tailrace connector at Inskip powerhouse, and dam removal. More benefit due to better tailrace facility at South Powerhouse compared to 3D, and due to additional dam removal compared to PA.

- Large benefit from instream habitat stability and continuity due to prescribed ramping rates.

- No benefit from ensuring availability of instream flows in the future due to dedication of water rights.

- Moderate benefit from adaptive management plan. Less benefit due to lack of existing funding compared to PA. No funded water acquisition account.

- Large benefit from increased or enhanced wetted, wetland, and riparian habitat area and improved wetted habitat temperature and stability due to increased minimum flows, tailrace and penstock bypass facilities, prescribed ramping rates, and possibly dam removal.

- Large benefit from increased bat habitat availability due to decommissioning of South Canal tunnels.

Three-Dam Removal Alternative (3D)

- Large benefit from increased spawning and rearing habitat area due to increased minimum flows. More benefit on Baldwin Creek compared to ND.

- Large benefit from increased fry and juvenile production due to increased minimum flows. More steelhead juvenile benefit on South Fork compared to PA and 6D.

- Moderate benefit from increased area of cold water refugia. Less benefit compared to PA and 6D due to release of spring water at Eagle Canyon and Baldwin Creek, but not Soap Creek or lower Ripley Creek.

- Moderate benefit from reduced false attraction. Less benefit compared to PA and 6D due to lack of penstock bypass (but has tailrace connector) at Inskip powerhouse; South powerhouse has less effective tailrace separator channel instead of tailrace connector.

- Moderate benefit from passage at natural barriers due to increased minimum flow. Less benefit due to lower minimum flow regime compared to PA and 6D.

- Large benefit from passage at diversion dams due to new fish ladders and dam removal. Possibly more benefit due to more dams removed compared to ND. Possibly less benefit due to fewer dams removed compared to PA and 6D.

- Large benefit from passage at diversion intakes due to new fish screens and dam removal. Possibly more benefit due to more dams removed compared to ND. Possibly less benefit due to fewer dams removed compared to PA and 6D.

- Moderate benefit from instream habitat stability and continuity due to tailrace separator channel at South Powerhouse, tailrace connector at Inskip powerhouse, and dam removal. Less benefit due to less effective tailrace facility at South Powerhouse, lack of penstock bypass at Inskip Powerhouse, and less dam removal compared to PA and 6D.

- Large benefit from instream habitat stability and continuity due to prescribed ramping rates.

- No benefit from ensuring availability of instream flows in the future due to dedication of water rights.

- Moderate benefit from adaptive management plan. Less benefit due to lack of existing funding compared to PA. No funded water acquisition account.

- Large benefit from increased or enhanced wetted, wetland, and riparian habitat area and improved wetted habitat temperature and stability due to increased minimum flows, tailrace facilities, prescribed ramping rates, and possibly dam removal. Possibly less benefit due to lower minimum flow regime, less effective tailrace facility at South Powerhouse, and less dam removal compared to PA and 6D.

- Possible benefit from increased bat habitat availability.

Based on initial review of the expected benefits from each action alternative and associated potential incidental impacts, the Service's provisional interpretation of the data is that the Proposed Action (Five Dam Removal Alternative) would best achieve Restoration Project objectives, and be most consistent with objectives of pre-existing anadromous fish restoration plans, and the CALFED ERP. The Proposed Action would provide more overall benefits to the anadromous fish ecosystem than the other alternatives, would most substantially improve the reliability of fish passage. The Proposed Action also would provide the best probability for achieving desired results through monitoring and adaptive management. Moreover, additional benefits to the riparian corridor ecosystem would be greatest through the Proposed Action.

RECOMMENDATIONS

The proposed Restoration Project is designed to benefit anadromous fisheries and instream habitat, and also should benefit adjacent riparian ecosystem. To help maximize the Restoration Project's contribution to fishery and overall ecosystem quality in the Restoration Project area, the Service provides the following recommendations:

1. Select and implement the Restoration Project's Proposed Action.

2. Enhance other ecosystem components, such as wetland, bat habitat, and canyon corridor pathways, to the extent feasible.

3. Avoid adverse impacts to fish and wildlife and their habitats to the extent possible, and minimize adverse impacts that are unavoidable, as provided for in the Restoration Project's mitigation strategies defined in the Draft EIS/EIR. This would reduce loss of existing biological values in the project area; reduce planning, land acquisition, and funding needed for mitigation; and maximize overall Restoration Project benefits.

4. Initiate ESA section 7 consultation with this office and NOAA Fisheries to determine potential project effects on listed and other special status species, and incorporate appropriate Terms and Conditions and conservation measures for affected species into Restoration Project implementation.

5. Implement mitigation measures provided by the Service, as applicable for migratory birds (Attachment B), bats (Attachment C), and site-specific impacts (Attachment D), and as may be provided in the final FWCA report.

6. Develope and implement a *Post Construction Mitigation/compensation/restoration and Reporting Plan*, as provided for in the Restoration Project EIS/EIR, with consideration to the Service's mitigation recommendations.

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ATTACHMENT A

Endangered and Threatened Species that May Occur in
or be Affected by Projects in the Quads Listed at the End of this Report

Battle Creek Salmon and Steelhead Restoration Project

July 2, 2003

Listed Species

Birds

bald eagle, *Haliaeetus leucocephalus* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T)

Central Valley steelhead, *Oncorhynchus mykiss* (T)

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

delta smelt, *Hypomesus transpacificus* (T)

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)

Invertebrates

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

Plants

slender Orcutt grass, *Orcuttia tenuis* (T)

Proposed Species

Invertebrates

Critical habitat, vernal pool invertebrates, *See Federal Register 67:59883* (PX)

Plants

Critical habitat, vernal pool plants, *See Federal Register 67:59883* (PX)

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C)

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C)

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C)

green sturgeon, *Acipenser medirostris* (C)

Species of Concern

Mammals

California wolverine, *Gulo gulo luteus* (CA)

Sierra Nevada red fox, *Vulpes vulpes necator* (CA)

Sierra Nevada snowshoe hare, *Lepus americanus tahoensis* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

fisher, *Martes pennanti* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

long-legged myotis bat, *Myotis volans* (SC)

pale Townsend's big-eared bat, *Corynorhinus (=Plecotus) townsendii pallescens* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

spotted bat, *Euderma maculatum* (SC)

Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (D)

American dipper, *Cinclus mexicanus* (SLC)

American peregrine falcon, *Falco peregrinus anatum* (D)

California spotted owl, *Strix occidentalis occidentalis* (SC)

California thrasher, *Toxostoma redivivum* (SC)

Lawrence's goldfinch, *Carduelis lawrencei* (SC)

Lewis' woodpecker, *Melanerpes lewis* (SC)

Nuttall's woodpecker, *Picoides nuttallii* (SLC)

Vaux's swift, *Chaetura vauxi* (SC)

bank swallow, *Riparia riparia* (CA)

black swift, *Cypseloides niger* (SC)

ferruginous hawk, *Buteo regalis* (SC)

flammulated owl, *Otus flammeolus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

loggerhead shrike, *Lanius ludovicianus* (SC)

long-billed curlew, *Numenius americanus* (SC)

oak titmouse, *Baeolophus inornatus* (SLC)

prairie falcon, *Falco mexicanus* (SC)

rufous hummingbird, *Selasphorus rufus* (SC)

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

white-faced ibis, *Plegadis chihi* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Spea hammondii* (SC)

Fish

longfin smelt, *Spirinchus thaleichthys* (SC)

river lamprey, *Lampetra ayresi* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

California linderiella fairy shrimp, *Linderiella occidentalis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Plants

Ahart's whitlow-wort (=Ahart's paronychia), *Paronychia ahartii* (SC)

Boggs Lake hedge-hyssop, *Gratiola heterosepala* (CA)

Butte County catchfly (=long-stiped campion), *Silene occidentalis ssp. longistipitata* (SC)

Butte fritillary, *Fritillaria eastwoodiae* (SC)

silky cryptantha, *Cryptantha crinita* (SC)

valley sagittaria (=Sanford's arrowhead), *Sagittaria sanfordii* (SC)

Quads Used in Report:

627D
645D
626C
627A
627B
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KEY:

(E)	Endangered	Listed (in the Federal Register) as being in danger of extinction.
(T)	Threatened	Listed as likely to become endangered within the foreseeable future.
(P)	Proposed	Officially proposed (in the Federal Register) for listing as endangered or threatened.
(PX)	Proposed Critical Habitat	Proposed as an area essential to the conservation of the species.
(C)	Candidate	Candidate to become a proposed species.
(SC)	Species of Concern	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(MB)	Migratory Bird	
(D)	Delisted	Delisted. Status to be monitored for 5 years.
(CA)	State-Listed	Listed as threatened or endangered by the State of California.
(*)	Extirpated	Possibly extirpated from this quad.
(**)	Extinct	Possibly extinct. Critical Habitat Area essential to the conservation of a species

ATTACHMENT B

MEMORANDUM

August 30, 2001

To: Mary Marshall and Dave Gore, U.S. Bureau of Reclamation

From: Bart Prose, U.S. Fish and Wildlife Service

Subject: Draft Impact Mitigation Measures for Birds Potentially Affected by the Battle Creek Salmon and Steelhead Restoration Project

The following recommendations were developed to avoid and minimize, in that order of priority, adverse effects on bird species associated with the project area due to construction activities. Adverse effects could result from direct habitat destruction or disturbance from construction activity. These measures do not apply to listed or proposed species under the Federal or State Endangered Species Acts. If listed or proposed species may be affected by the project, it would be necessary to consult with the Fish and Wildlife Service (FWS) or California Department of Fish and Game (CDFG) before any impacts occur.

The mitigation approach is based on minimizing construction footprints, scheduling construction activities with consideration to seasonal habitat needs of birds, considering species sensitivities and tolerance to construction activity and noise, allowing birds to choose nesting sites given exposure to construction disturbance, and developing contingency measures for specific circumstances that must be handled on a case by case basis.

Hazing to prevent birds from establishing nests near construction sites generally is not recommended under this mitigation approach, but is an option in some situations during the first year of construction. Hazing is a last resort, as birds that are forced out of their selected nest sites may not find other suitable sites and risk a year of lost productivity. Instead the birds would be confronted with construction disturbance that would be typical of the site during the breeding season (February 1 through August 31), and left to choose whether to remain or look elsewhere. Those that remain despite construction disturbance may have a better chance to produce young than if forced off the site by hazing.

Table B-1 lists representative birds species that may occur at or near construction sites and summarizes habitats used, specific breeding dates, buffer sizes to minimize disturbance, and known occurrences on the study area. Mitigation measures emphasize raptors, as they are early nesters with a long breeding season, are particularly sensitive to disturbance, require relatively large breeding territories, and produce fewer offspring. These characteristics of raptors make them particularly vulnerable to significant impacts. Additional species are included in Table B-1 due to their rarity and Federal or State regulatory status as Species of Concern or Species of Special Concern, respectively. A general category comprising most other species that could occur on the study area also is included, as these species are protected under the Migratory Bird Treaty Act.

Once a nest is established and eggs or nestlings are present, the nest and its contents are protected under the Migratory Bird Treaty Act. Golden Eagles are also protected under the Bald Eagle Protection Act. Bald Eagles are protected under both aforementioned acts, and the Endangered Species Act.

Mitigation measures emphasize the breeding season, as this is generally the most sensitive period of the annual biological cycle. During other times of year, birds generally are more mobile and less dependent on specific sites to meet their needs. However, species that depend on relatively rare habitat features, such as cavities in dead trees (snags) or stumps for roosting at night or during the winter, could be significantly affected at times outside of the breeding season if these sites are damaged or disturbed, as these features are often in short supply.

Mitigation Measures

The following mitigation measures should be implemented, as applicable, for all project construction:

- If pre-construction surveys are performed for California spotted owls, all other raptor nests and raptor activity observed during the surveys also should be recorded to help estimate the potential for occurrence of other raptors during construction.

- Construction footprints should be kept as small as possible

- Known or potential nesting and roosting sites, such as live trees with cavities and all snags and stumps, should be protected to the extent practicable year-round.

- Existing nests of raptors or any other bird should not be removed from their locations.

The following mitigation measures should be implemented for all project construction. During the first construction year, certain measures that would begin prior to July 15 may not be practicable. In this case, contingency measures are further provided below:

- Construction activities that could adversely affect nesting birds and rearing of young through take of nests, impacts to nesting habitat, or disturbance from noise or human activity, should be limited to the period between September 1 and February 1 to avoid the bird breeding season.

- Any habitat providing nesting cover for birds, such as grassland, mixed chaparral, live oak woodland, blue oak woodland, gray pine/oak woodland, and westside ponderosa pine, that must be removed for construction purposes, should be removed between September 1 and February 1 prior to construction.

- If construction at a site must occur between February 1 and August 31, it should begin by February 1, and typical levels of activity and noise disturbance that would occur at the site should be sustained on a routine basis through the end of August, or until construction is completed.

- Construction sites should be monitored for bird nesting activity during the breeding season.

- If raptors or any other birds appear at or near a construction site and attempt to nest, typical levels of construction noise and activity that will occur at the site during the breeding season should be sustained, such that the birds can accept or reject the site based on their assessment of the disturbance. Unless it is known that the nest site will be physically disturbed, the birds should be allowed to nest if they choose under the assumption that they will be able to tolerate construction noise and activity.

- If disturbance of a nest with eggs or young appears unavoidable, or nesting activity, such as incubation or feeding of young, may be affected, a project contact at FWS and DFG should be consulted before disturbance occurs.

- If potential nesting habitat must be impacted during the breeding season, a project contact at FWS and DFG should be consulted before disturbance occurs.

- If a project site meets buffer zone criteria in Table B-1 for an active nest during the breeding season, disturbance probably can be assumed insignificant, but FWS and DFG still should be contacted for known occurrences of these species on the project area.

The following mitigation measures should be implemented, as applicable, for all project construction during the first construction year, that due to scheduling constraints, cannot follow the preceding measures that require implementation prior to July 15:

- During the first construction year, regulatory compliance and construction contracting for the project is not expected to be completed until about April, 2002. Because it would be necessary to begin construction as early as possible (July 15 is the earliest possible starting date anticipated), it may be necessary to remove vegetated habitats and commence with potentially disruptive construction activities during the bird breeding season within the first construction year. If during the first year of project construction it would be necessary to impact potential nesting habitat or conduct disruptive construction activities between July 15 and September 1, the following measures should be implemented for birds other than ESA- listed species:

  a) Affected project sites should be monitored by a qualified biological monitor for breeding bird activity February 1 through August 1.

  b) If nesting behavior or nest building activity by birds is observed within habitat areas to be removed during the nesting season, or is observed near areas to be affected by construction, such that nesting success would be doubtful, nesting in those habitat areas should be discouraged, as necessary, unless egg laying has already begun. Nesting can be discouraged by hazing or removing partially constructed nests.

  c) Likelihood of nesting success and the necessity to discourage nesting in affected areas would depend on the species of bird, time of nest initiation, buffer zone considerations, type of construction work involved, and time of construction initiation. This would be determined on a case-by-case basis by the biological monitor in coordination with DFG and FWS.

  e) After August 1, monitoring of sites for breeding behavior and activity can be discontinued.

Table B-1. Habitats, breeding seasons, and buffer zones for birds that may be associated with the Battle Creek Salmon and Steelhead Restoration Project.

Species	**Habitat** (CDFG 1990, JSA 2001)	**Breeding Dates**	**Buffer Zone**[1]	**Known Occurrences** (JSA 2001)
Turkey Vulture	All open habitats with large trees, snags, or cliffs	Early May through August (CDFG 1990)	0.5 miles direct line of site (SFWOa)	Observed at all project sites
Osprey	Fish-bearing waters and associated conifer forest	Mid-March through August (CDFG 1990)	0.5 miles direct line of site (Richardson and Miller 1997)	Active nest 1.3 miles downstream of South Diversion Dam, south bank; several fly-overs in study area
White-Tailed Kite	Open oak woodland, grassland, and riparian	Early February through October (CDFG 1990)	0.25 miles direct line of site (SFWO)	Occurrence uncertain
Bald Eagle[2]	Blue oak woodland to ponderosa pine within 0.5 miles of large water bodies	Mid-January through July (SFWOb)	0.5 miles direct line of site (SFWOb)	No known nests in study area; single immature sighted at Coleman Diversion Dam; several fly-overs in study area

Sharp-Shinned Hawk	Conifer and riparian forest	Early April through August (CDFG 1990)	0.25 miles direct line of site (Richardson and Miller 1997)	Breeding unknown on study area; several observations on study area April and September during spring and fall migration
Cooper's Hawk	Deciduous, conifer, and mixed woodlands, usually near water	Early March through August (CDFG 1990)	0.25 miles direct line of site (Richardson and Miller 1997)	Breeding unknown on study area; single immature observed July, 2000
Red-Tailed Hawk	Most habitats on project area	Early February through August (CDFG 1990)	0.5 miles direct line of site (Richardson and Miller 1997)	Observed at all project sites
Golden Eagle	Grassland and blue oak woodland	Early February through August (Richardson and Miller 1997)	0.5 miles direct line of site (Richardson and Miller 1997)	Unused nests at headwaters of Soap Creek Feeder and across the creek from South Powerhouse; several fly-over individuals/pairs observed on study
American Kestrel	Most habitats	Early March through August (CDFG 1990)	0.25 miles direct line of site (Richardson and Miller 1997)	Observed at Coleman Diversion Dam and Inskip Diversion Dam/South Powerhouse

Peregrine Falcon	Cliffs and rocky canyons near open areas, especially with water	Early February through August (Richardson and Miller 1997)	0.5 miles direct line of site (Richardson and Miller 1997)	Occurrence uncertain
Barn Owl	Most habitats except dense forest; Out buildings	Early January through November (CDFG)	0.25 miles direct line of site (SFWOa)	Observed foraging in grassland areas
Western Screech Owl	Oak, riparian, and conifer forest edges	Early February through June (CDFG 1990)	0.25 miles direct line of site (SFWOa)	Observed foraging in grassland areas
Great-Horned Owl	Forest and shrub habitats, especially with edges and openings	Mid-January through June (CDFG 1990)	0.25 miles direct line of site (SFWOa)	Occurrence uncertain
Northern Pygmy Owl	Most forest types	Early April through August (CDFG 1990)	0.25 miles direct line of site (SFWOa)	Occurrence uncertain
California Spotted Owl	Dense, mature, multi-layered conifer forest; other conifer forest, conifer-hardwoods, and riparian forest in steep canyons	Early March through June (USDA 2001), but may extend through July	0.25 miles direct line of site (USDA 2001)	Occurrence uncertain
Vaux's Swift	Large hollow trees, snags, and stubs	Early May through mid-August (CDFG 1990)	Site specific determination, as necessary	Blue oak woodland fly-over near project area; pair observed at Lower Ripely Creek Feeder

Little Willow Flycatcher	Wet mountain meadows and riparian forest with standing water, languid streams, or seeps, and dense willows and associated vegetation	Early May through August (CDFG 1990)	Site specific determination, as necessary	Migrants observed at Eagle Canyon Dam and Lower Ripley Creek Feeder. Potential nesting habitat at Lower Ripely Creek Feeder
Yellow-Breasted Chat	Riparian habitats with dense shrubs and woody thickets, especially blackberry	Early May to mid-August (CDFG 1990)	Site specific determination, as necessary	Observed at Darrah Springs Feeder, Coleman Diversion Dam/Inskip Power House, Lower Ripely Creek Feeder, and Inskip Diversion Dam/South Power House
Other Migratory Bird Treaty Act Protected Species (e.g., Herons, Ducks, Vultures, Doves, Hummingbirds, Kingfishers, Woodpeckers, and Passerine Species)	Annual grassland, mixed chaparral, live oak woodland, blue oak woodland, gray pine/oak woodland, westside ponderosa pine	Early February through August, depending on species (CDFG 1990)	Site specific determination, as necessary	See JSA 2001 Appendix D for known occurrences

[1] Buffer distances may be less if landscape features obstruct line of sight to nests

[2] Project work that may affect this species will require consultation under the Federal Endangered Species Act of 1973, as amended.

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SFWOa (Sacramento Fish and Wildlife Office). Criteria provided by U.S. Fish and Wildlife Service's SFWO. Extrapolated from published criteria for related species.

SFWOb (Sacramento Fish and Wildlife Office). Criteria provided by U.S. Fish and Wildlife Service's SFWO. Typical criteria used for ESA consultations.

USDA. Forest Service. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement. Vol. 1, Chapter 2. USDA Forest Service Pacific Southwest Region.

ATTACHMENT C

MEMORANDUM

August 27, 2001

To: Mary Marshall and Dave Gore, U.S. Bureau of Reclamation

From: Bart Prose, U.S. Fish and Wildlife Service

cc: Jim Goodwin, U.S. Bureau of Reclamation
Joel Medlin, U.S. Fish and Wildlife Service
Harry Rectenwald and Steve Turek, California Department of Fish and Game

Subject: Preliminary Mitigation Recommendations for Bats Potentially Affected by the Battle Creek Salmon and Steelhead Restoration Project

The subject mitigation recommendations provide preliminary information to assist in project planning. Additional detailed information from bat specialists and input from the California Department of Fish and Game will be needed to further develop a mitigation approach. These preliminary recommendations are consistent with the Fish and Wildlife Service's Mitigation Policy (Federal Register 46:15; January 23, 1981), which defines mitigation to include avoiding impacts, minimizing impacts, rectifying impacts. reducing impacts over time, and compensating for impacts. The Fish and Wildlife Service considers these elements to represent the most desirable sequence of steps in the mitigation planning process. The Mitigation Policy is not applied to project impacts on federally-listed endangered or threatened species, which are considered separately, as provided for in the Endangered Species Act of 1973, as amended (ESA).

Many bat species potentially occurring on the project area are rare and have Federal or State regulatory status as Species of Concern or Species of Special Concern, respectively. Populations of many bat species have declined drastically in the U.S. and worldwide due to human actions (Harvey et al. 1999). This has resulted from mine closures, foraging habitat loss, vandalism, disturbance of hibernation and maternity colonies, and use of pesticides, among others. Bats aroused during hibernation use up critical stores of winter fat, which could lead to starvation. A single arousal could result in energy expenditure equal to 2-3 weeks of undisturbed hibernation (Harvey et al. 1999). Maternity colonies will not tolerate disturbance, and young flightless bats could be dropped to the ground and lost, or abandoned by the adults.

Bats on the project area could be adversely affected by direct habitat loss due to closure of tunnels, or disturbance from construction noise and human activity near tunnels used by bats. Bats also are susceptible to loss of other habitat features, such as cliffs, rocky outcrops, buildings, natural caves, and roosting trees, and human disturbance near these features. Bats can be impacted by adverse effects to foraging habitat, including loss of habitat and human disturbance during foraging hours.

Mitigation recommendations are based on ascertaining presence of bats and bat habitat on the project area, scheduling construction relative to seasonal habitat needs and sensitivity of bats to disturbance, considering species tolerance to construction activity and noise, and compensating lost habitat value with consideration to specific habitat needs of bats. Table C-1 lists Fish and Wildlife Service bat Species of Concern that may occur at or near construction sites, and summarizes temporal patterns, habitat requirements, and welfare factors and concerns.

The goal is to avoid impacts to bats to the extent practicable, minimize impacts that are unavoidable, and compensate lost bat habitat value, such that the project has no net adverse effect on bats. In addition due to the precarious population status of many bat species in California, the project should make all reasonable efforts to enhance habitat conditions for bats on the project area if such alternatives can be implemented at a financial cost comparable to other alternatives. For example, if decommissioned tunnels can be preserved and fitted with bat gates at a cost less or comparable to sealing off the tunnels entirely, tunnel preservation should be selected.

Mitigation Measures

- Construction footprints should be kept as small as possible.

- All tunnels targeted for closure due to the project should be surveyed for present use, past use, and potential use by bats.

- Other tunnels near construction sites, as well as other potential bat habitat, should be surveyed for bats if bats could be adversely affected by construction noise or other disturbance. Susceptibility to disturbance would depend on factors such as type of disturbance, distance to construction site, bat species present, and purpose of use by bats (e.g., roosting, breeding, migration, hibernation).

- If bats are present in tunnels affected by the project, or in other tunnels or bat habitats within range of disturbance by construction activities, construction scheduling, buffer zones, and other mitigative measures to avoid disturbance should be developed in consultation with bat specialists and the Service before disturbance occurs.

- If disturbance of a site used by bats is unavoidable, appropriate mitigation measures should be developed in consultation with bat specialists and the Service before disturbance occurs.

- Mitigation measures for construction disturbance should be based on seasonal habitat needs and sensitivity of bats to disturbance. The preliminary mitigation approach recommended for breeding birds probably is not suitable for bats, as bat habitats are very specialized and alternative sites for bat use may rare on and near the study area (i.e., affected bats may not have alternative habitat available).

- Decommissioned tunnels should not be completely and permanently sealed if they are used by bats or have potential for use by bats. Instead, decommissioned tunnels should be modified, as appropriate, to preserve, enhance, or provide new bat habitat. This could include de-watering tunnels and installing bat gates.

- If permanent, complete closure of tunnels used by bats or tunnels providing potential bat habitat, appears necessary, Reclamation should consult with the Service to investigate alternatives and assess the potential for habitat compensation. If impacts to habitat are unavoidable, compensatory habitat of greater or equal value should be established as near the project site as possible.

- If other existing tunnels on the project area are proposed as compensatory bat habitat, tunnels should be surveyed for bat use to determine whether they are suitable for that purpose. Suitability would depend of factors such as existing habitat suitability for bats, existing bat occupancy, species of preexisting bats, potential to provide compensatory habitat values for those lost (e.g., roosting, breeding, migration, or hibernation habitat), and potential for enhancing habitat value of compensatory tunnels to achieve a net gain equal to habitat value lost at impacted tunnels (habitat value enhancement can be measured by the numbers of additional bats that can occupy the enhanced tunnels, which should be at least equal to the numbers of bats that lost habitat).

- Construction sites should be monitored for bat activity throughout the year and through project completion to identify potential conflicts with bats that were previously unknown.

- Potential bat habitat, such as caves, large trees (dead or living), tree stumps, cliffs, rocky outcrops, etc., should be protected to the extent practicable year-round.

Table C-1. Life history and welfare factors and concerns for bat Species of Concern that may be associated with the Battle Creek Salmon and Steelhead Restoration Project.

Species	Temporal Patterns	Habitat Requirements	Welfare Factors & Concerns
Pale Townsend's big-eared bat [*Corynorhinus (=Plecotus) townsendii* pallescens]	Hibernation colonies begin forming late October; numbers peak by January (USDA 2001). Hibernation in clusters of a few to more than 100 bats (Harvey et al. 1999). Breeding starts within first 3 weeks of October (USDA 2001). Females congregate at maternity sites in March and June; males solitary at this time. Maternity colonies of one or more clusters up to 100 bats. Usually single pup born between May and July, fly within 3 weeks, and leave nursery roost after two months. Long distance migrations unknown (Harvey et al. 1999).	Primarily cave and mine use, but also buildings (USDA 2001). Require specific structural and microclimate conditions; not all caves or mines have these conditions. High roost site fidelity. Hibernate where temperature is 54 degrees F or less, but generally above freezing, and often near cave or mine entrances in well ventilated areas (Harvey et al. 1999). Females prefer cooler locations for hibernation; maternity colonies generally in darker, warmer locations (USDA 2001). Are aerial foragers concentrating on forest edges (Harvey et. al. 1999). Prefers native habitat and feeds primarily on moths. Requires access to free water (USDA 2001).	Substantial population declines have occurred over last 40-60 years (USDA 2001). Majority of roost loss due to human activity. Apparently limited by roost site availability and are very sensitive to human disturbances. If disturbance lasts more than a few seconds, entire colony takes flight. May abandon roost once disturbed. Respond readily to roost site protections such as gates. Conversion of native habitat and loss of riparian habitat pose a threat to foraging.

spotted bat (*Euderma maculatum*)	Capable of torpor, and hibernate in some areas (USDA 2001). Appear solitary but may hibernate in small groups. May make altitudinal migration from forest to lowlands in autumn. Emerge about an hour after dark and return to day roost about an hour before sunrise (Harvey et al. 1999). In the spring they spend 3-5 minutes foraging per clearing, but more time is spent around the same area in the summer. One young born per year in June (USDA 2001).	Strongly associated with rock features, such as cliffs and crevices (USDA 2001). Appear to have sexual segregation (females at higher elevations). Are generally solitary roosters high in cliff crevices, and occasionally found in caves and buildings. Foraging along mosaic edges of forest, riparian habitats associated with small to mid-size streams in narrow canyons, wetlands, and meadows. Feed in flight over water, along washes, and near ground.	One of rarest mammals in North America (USDA 2001). More restrictive roosting and foraging requirements than other bats. Roosts may be limited by lack of foraging habitat. Roost sites can be affected by human activities disturbing cliffs, rocky outcrops, caves, and buildings. An extremely fragile species can be injured during capture and handling (Oliver 2000).

fringed myotis bat (*Myotis thysanodes*)	Hibernation occurs from October to March (USDA 2001). Short local migrations may occur to suitable hibernacula, but extensive migrations are unlikely. A maternity group (typically 200 bats) may remain together through hibernation. Mating takes place in autumn and one young is born between late May and early July. After birth, young are placed in a separate cluster from adults; adults fly back and forth between roost and feeding young (Harvey 1999). Young can fly in 20 days (USDA 2001).	Habitat includes valley foothill hardwood, hardwood-conifer, and riparian areas (USDA 2001). Forage in flight over water, open habitats, and early succession vegetation. May glean from vegetation. Roost in tree cavities, caves, buildings, bridges, mines, and rock crevices on cliff faces. Separate day and night roosts may be used. Maternity colonies may be relatively cool and wet sites, and the sites may change in response to temperature in the roost. Adult males roost separate from maternity colonies (USDA 2001). Requires drinking water.	Highly sensitive to disturbance at roosting sites. Adversely affected by cave and mine exploration, and reduction of tree roosts (large snags) (USDA 2001). Heavy grazing may affect prey base and habitat.

long-eared myotis bat (*Myotis evotis)*	Thought to migrate to different elevations to hibernate (USDA 2001). Little is known of winter activity (CDFG 1990). Females form maternity colonies in summer, whereas, males and non-breeding females live singly or in small groups, occasionally occupying the same site as a maternity colony, but roosting apart from it (Harvey et al. 1999). One young is born in late June or early July. Species emerges at dusk to forage.	Roosting generalists, singly or in groups of less than 30 (USDA 2001). Found in buildings, cliff crevices, snag and live tree cavities, behind bark, caves, mines, rocky outcrops, and bridges. Caves usually used as night roosts (CDFG 1990). Foraging habitat includes forest edges, streams, riparian areas, open tree stands, and open areas without trees. Primarily a gleaner, also forage in flight, between and within treetops. Requires drinking water.	Show high roost site fidelity. Heavy grazing may impact prey through reduction in grasses and herbaceous vegetation. Adversely affected by cave and mine exploration, and reduction of tree roosts (large snags) (USDA 2001).

long-legged myotis bat (*Myotis volans*)	Relatively tolerant of cold temperatures, which may extend the pre-hibernation period (Harvey et al. 1999). Believed to make short, local migrations for hibernation (USDA 2001). There are usually more males than females at hibernation sites (Harvey et al. 1999). Maternity colonies are moderately gregarious, as are late summer swarming and hibernation groups. In Canada, they swarm in August and begin hibernation by late September (Nagorsen and Brigham 1993). Females give birth between May and August. Emerge early evening to forage and active throughout the night with peak activity in first 3-4 hours after sunset.	Roosting habitat generalist with preference for snags and large trees (USDA 2001). Also uses buildings, rock crevices, and under tree bark (USDA 2001). Caves and mines may be used as hibernacula (Harvey et al. 1999) and night roosts (USDA 2001). Maternal colonies usually occur in hollow trees, under bark, rock crevices, buildings (USDA 2001), and stream banks (Harvey et al. 1999). Foraging habitat includes edges, streams and riparian areas, and open stands. Prey caught in flight, generally 10 to 15 feet over water, close to trees and cliffs, and in openings in woodlands & forests (USDA 2001).	Adversely affected by reduction in roosting trees, urbanization, timber harvest, and insecticide use (USDA 2001).

small-footed myotis (*Myotis ciliolabrum*)	Movements to hibernacula probably local (CDFG 1990). Hibernate in groups of up to 50 or more bats, from November to March (USDA 2001). Maternity colonies of 12-20 individuals. Typically one, but sometimes two, young born between May and June (Harvey et al. 1999). Most young fly by mid-August (CDFG 1990). Males tend to roost singly (USDA 2001). Begin foraging at dusk shortly after sunset with peaks of activity between 10pm and 12pm and 1am and 2 am (CDFG 1990).	Seemingly prefer arid habitats (Harvey et al. 1999). Habitat occurs in deserts, chaparral, riparian zones, coniferous forest and other arid uplands, near water, up to 8,900 feet elevation. Use small, protected crevices that are hot and dry (Nagorsen and Brigham 1993), but may prefer humid roosts (CDFG 1990). Roosts in caves, buildings, mines, rock/cliff crevices, clay banks, spaces between rocky talus slopes and boulders, and occasionally under bridges and under bark (Harvey et al. 1999). Often hibernate in cold drafty places (USDA 2001). Maternity colonies can be found in caves, mines, and buildings. Riparian areas and open tree stands used for foraging. Forage over water, close to rocks and cliffs, and among trees. Requires water often; streams, ponds, springs, and stock tanks utilized for drinking (USDA 2001). May be found feeding or roosting with other bat species (CDFG 1990).	Adversely affected by mining, rock climbing, cave and mine exploration, reservoir construction, urbanization and other habitat loss or alteration activities (USDA 2001). Prey base may be affected by insecticide use.

Yuma myotis bat (*Myotis yumanensis*)	Winter habits poorly understood, but probably make local or short migrations to hibernation sites (CDFG 1990). In late May and early June nursery colonies form (Harvey et al. 1999). Males scatter and lead solitary lifestyle, foraging at higher elevations (Grinnel 1918). One young born in late May or early June (Harvey et al. 1999). Nursery roost abandoned in autumn, for migration (dispersal) (unknown location and distance). Emerge to forage when nearly dark. After feeding, it retreats to a temporary night roost near feeding area (Nagorsen and Brigham 1993).	Habitat generally in areas with open water, riparian areas, woodlands and open areas (Nagorsen and Brigham 1993). Roost in buildings, mines, caves, crevices, and under bridges (CDFG 1999). Nursery roosts may occur in buildings, caves, mines, and under bridges (Harvey et al. 1999), and warm, dark sites are preferred (CDFG 1990). Nursery colony cluster behavior known to relate to temperature changes, and bats pack close together when in cooler temperature (Nagorsen and Brigham 1993). Forage primarily over water (Nagorsen and Brigham 1993).	Nursery roost abandoned if et. al 1999).

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USDA. Forest Service. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement. Appendices, Vol. 3, Chapter 3, Part 4. USDA Forest Service Pacific Southwest Region.

ATTACHMENT D

SPECIFIC MITIGATION MEASURES

North Battle Creek Feeder

- The proposed road to access the new fish screen and ladder should be as narrow and short as possible, so that only a minimal amount of the high value quality oak and riparian habitat would be lost or impacted.

- Construct drainage control for the road that would collect runoff and excessive levels of eroded sediment before it could enter the creek. This may require sediment basins that would occasionally need to be cleaned out.

- Construct staging and facility maintenance areas at the bottom of the road should be as small as possible to minimize impacts to the high value oak, riparian, and wetland habitat.

Eagle Canyon Diversion Dam

- Avoid impacts to natural seeps and springs, as these are high value habitats that may be difficult to restore or replace.

Wildcat Canal

- If the canal is to be filled during decommissioning, loss of existing wetland values should be minimized by preserving or creating wetland areas along the canal that have seeps or other sources of water (e.g., water table or natural runoff topography) to maintain them.

Inskip Diversion Dam/South Power House

- Avoid using the proposed (may now be omitted from project description) oak woodland site as a borrow area (as it is well established oak woodland habitat), unless the excavation area can be contained within the grassy area in the southwest portion of the site. However, the grassy area may also be a suitable mitigation site for oak woodland impacts elsewhere on the South Power House/Inskip Dam areas, in which case it should be restored following project use.

- The permanent parking lot/construction staging area proposed near the new fish screen should be kept to minimal size to minimize impacts to high value oak woodland habitat. Large oak trees in the parking/staging area identified in the project EIS/EIR should be trimmed, as necessary, and preserved to extent feasible. If some oaks can be retained, the parking lot surface should be gravel, if feasible, to allow water to reach root zones of remaining trees.

- The short pipeline proposed at the outlet of the new bypass tunnel could form an obstacle to movements of wildlife in the riparian corridor. If the pipe is constructed above ground, an underpass should be provided for wildlife passage.

- The penstock bypass proposed for the Inskip Powerhouse could form an obstacle to movements of wildlife on the open chute portion of the bypass. Provide overpasses for wildlife use, and consider establishing underpasses past the existing penstock to further provide for wildlife movements.

Mt. Lassen Trout Farms

- If the springs used as hatchery water supplies are fenced off to exclude pathogen vectors (e.g., otters), assess lost habitat value to wildlife species that currently may be using the springs and provide replacement resources. It may be possible to divert a portion of the spring flow to establish a wetland nearby.

All Restoration Project Sites

- Consider use of decommissioned hydropower facility areas as potential compensation sites for other project impacts. In particular, provision of bat access to decommissioned tunnels and creation/preservation of wetland areas associated with Wildcat and South canals.